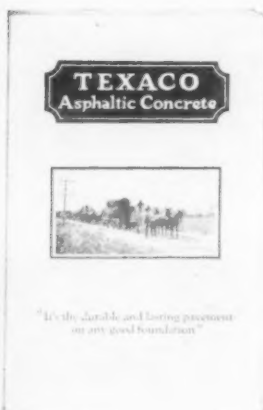


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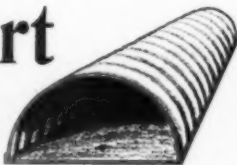
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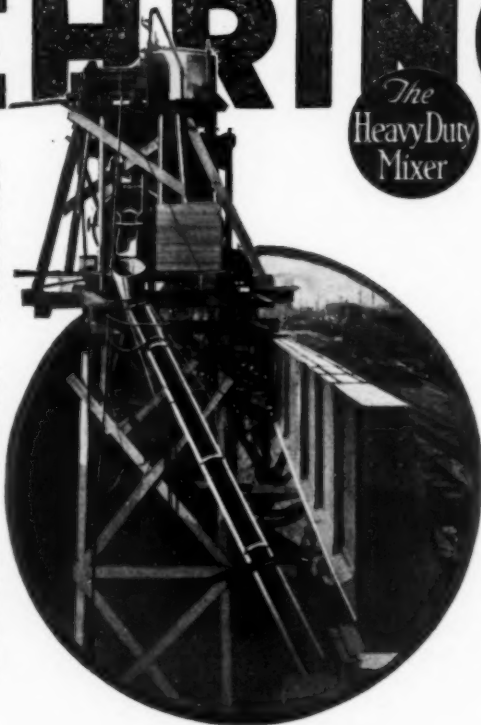
KOEHRING

*The
Heavy Duty
Mixer*

1. *No need to pound the Koehring charging skip to dislodge materials so they will slide into the drum; the high angle charging position of the skip due to the fact that it passes between the cable sheaves on the out-reaching arms of the frame, chutes materials into the drum in a swift, clean slide.*

2. *Extra liberal drum dimensions mean that every Koehring holds full capacity with room to spare for proper mixing action, and prevents splashing. Koehring remixing action delivers Dominant Strength Concrete, uniform to the last handful of every batch.*

3. *Koehring fast discharge is another time saver. The pivoting of discharge chute inside the drum affords a big area to receive a great volume of concrete. Also the pivoting of discharge chute inside the drum gives instant cut-off—easy to discharge a handful, or the batch.*



Capacity!

DRUM size alone does not mean capacity. Speed of charging and discharging, the ability of the mixer to maintain peak capacity operation without breakdowns, all these are the real factors of capacity.

KOEHRING CAPACITIES

Mixing cost per yard includes cost of maintenance and repairs and the greater cost of yardage and profit losses due to breakdown interruptions.

Koehring Heavy Duty Construction is your positive insurance of lowest yardage cost, both in yardage production, in lowest upkeep, fewest delays, and longest service life.

Heavy Duty Construction mixers 10, 14, 21, 28 cu. ft. mixed concrete, steam and gasoline.

Pavers: 10, 14, 21, 28 cu. ft. mixed concrete, spout, boom and bucket. Power discharge chute, multiplane traction, loading derrick, steam and gasoline.

Dandie Light Mixer 4 cu. ft. mixed concrete gasoline, 7 cu. ft. mixed concrete, steam and gasoline. Low charging platform. Power charging skip or batch hopper, light duty hoist.

Write for Koehring Construction Mixer Catalog C

KOEHRING COMPANY, MILWAUKEE WISCONSIN

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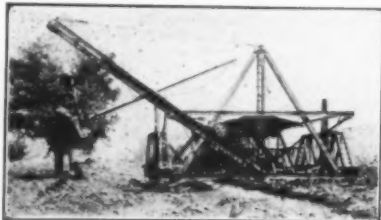
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For Drainage, Irrigation, Road or large tile ditches.

Capacities: $\frac{1}{2}$ to 1 Cubic Yard.

Spans the ditch.

Self propelling over rough or swampy ground.

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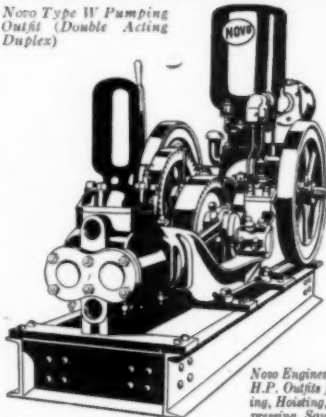
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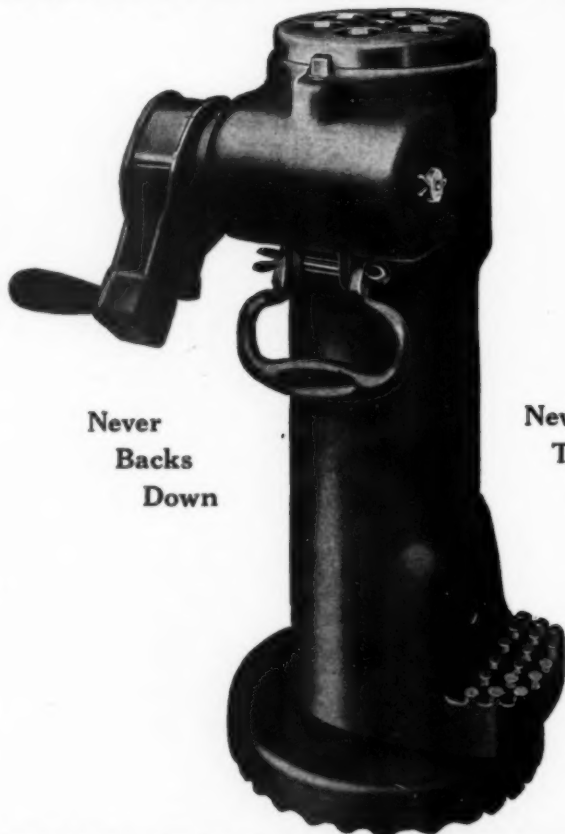
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Never
Backs
Down

Never
Turns
Around

THE DOUGHBOY JACK

—the lightest jack made for its capacity. Weighs considerably less than other jacks of equal power, in some sizes less than half as much.

Sizes for 15 to 100 tons

Easy to operate; a 24-inch handle provides ample leverage. Has a positive check to prevent damage from over-extension. Made of steel throughout.

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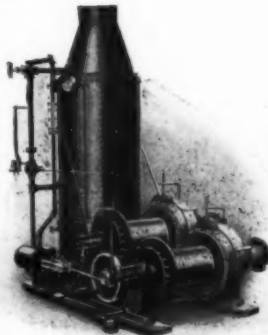


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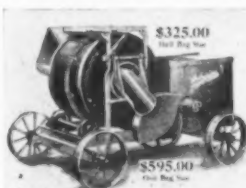
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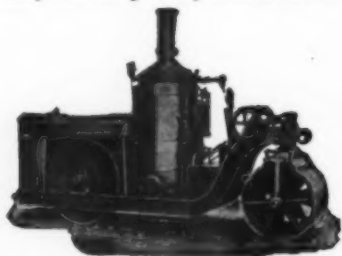
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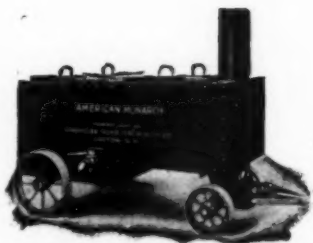
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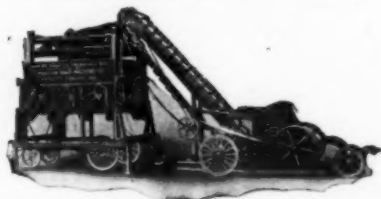
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Poston Paving Brick Co., Crawfordsville, Ind.
 Parington Paving Brick Co., Galesburg, Ill.
 Southern Clay Mfg. Co., Chattanooga, Tenn.
 Sterling Brick Co., Olean, N. Y.
 Thurber Brick Co., Thurber, Texas.
 Veedersburg Paver Co., Veedersburg, Ind.

PAVING MACHINERY

*Austin-Western Road Mch. Co., Chicago, Ill.
 *Barber Asphalt Paving Co., Philadelphia, Pa.
 *Buffalo-Springfield Roller Co., Springfield, O.
 *Equitable Asphalt Main. Co., Kansas City, Mo.
 *Koehring Machine Co., Milwaukee, Wis.
 Atlas Engineering Co., Milwaukee, Wis.
 Austin Machinery Corp'n, Chicago, Ill.
 Badger Concrete Mixer Co., Milwaukee, Wis.
 Construction Machinery Co., Waterloo, Ia.
 Cummer & Son Co., F. D., Cleveland, O.
 East Iron & Machine Co., Lima, O.
 Erie Machine Shops, Erie, Pa.
 Judy Mfg. Co., Centerville, Ia.
 Lakewood Engineering Co., Cleveland, O.

PAVING MATERIALS (See "Asphalt," "Paving Brick," "Granite Block," etc.)

PAVING MIXERS. (See Concrete Mixers)

PAVING TOOLS

*Barber Asphalt Paving Co., Philadelphia, Pa.
 *Connery & Co., Inc., Philadelphia, Pa.
 *Littleford Bros. Co., Cincinnati, O.
 *Warren Bros. Co., Boston, Mass.
 Anderson Tool & Sup. Co., W. H., Detroit, Mich.
 Kramer Bros. Fdry. Co., Dayton, O.
 Union Iron Works, Hoboken, N. J.

PERFORATED METALS

*Allis-Chalmers Mfg. Co., Milwaukee, Wis.

PICKS

Hubbard Co., Pittsburgh, Pa.
 Iron City Tool Works, Pittsburgh, Pa.
 Klein-Logan Co., Pittsburgh, Pa.
 Verona Tool Works, Verona, Pa.
 Warren Tool & Forge Co., Warren, O.
 Warwood Tool Co., Wheeling, W. Va.

PILE DRIVERS

*McKiernan-Terry Drill Co., New York.
 Browning Co., Cleveland, O.
 Clyde Iron Works, Duluth, Minn.
 Industrial Works, Bay City, Mich.
 Lidgerwood Manufacturing Co., New York.
 McMyler Interstate Co., Cleveland, O.
 Union Iron Works, Hoboken, N. J.

PILE HAMMERS, STEAM

*McKiernan-Terry Drill Co., New York.
 *National Hoisting Eng. Co., Harrison, N. J.
 Clyde Iron Works, Duluth, Minn.
 Union Iron Works, Hoboken, N. J.
 Vulcan Iron Works, Chicago, Ill.

PILING, INTERLOCKING STEEL

Carnegie Steel Co., Pittsburgh, Pa.
 Jones & Laughlin Steel Co., Pittsburgh, Pa.
 Lackawanna Steel Co., Buffalo, N. Y.

PIPE, CAST IRON

*Central Foundry Co., New York.
 *Lynchburg Fdry. Co., Lynchburg, Va.
 *U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
 American Cast Iron Pipe Co., Birmingham, Ala.
 Clow & Sons, J. B., Chicago, Ill.
 Fox & Co., John, New York.
 Glamorgan Pipe & Fdry. Co., Lynchburg, Va.
 National Cast Iron Pipe Co., Birmingham, Ala.
 Warren Fdry. & Machine Co., New York.
 Wood & Co., R. D., Philadelphia, Pa.

PIPE, CORE METAL

*Good Roads Mach'y Co., Philadelphia, Pa.
 *Newport Culvert Co., Newport, Ky.
 Canton Culvert & Silo Co., Canton, O.
 Hardesty Mfg. Co., Denver, Col.

PIPE, LEAD

*United Lead Company, New York.

PIPE, REINFORCED CONCRETE

Lock Joint Pipe Co., E. Orange, N. J.
 Massey Concrete Products Corp'n, Chicago, Ill.

PIPE, RIVETED STEEL

*Connery & Co., Inc., Philadelphia, Pa.
 *East Jersey Pipe Co., New York.
 *Komborst Co., J. S., Cincinnati, Ohio.
 *Littleford Bros. Cincinnati, Ohio.
 *Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.
 Abendroth & Root Mfg. Co., Newburgh, N. Y.
 American Spiral Pipe Works, Chicago, Ill.
 Blaw-Knox Co., Pittsburgh, Pa.
 Canton Culvert & Silo Co., Canton, O.
 Chatia. Boiler & Tank Co., Chattanooga, Tenn.
 Chicago Bridge & Iron Works, Chicago, Ill.
 Hammond Iron Works, Warren, Pa.
 Hardesty Mfg. Co., R., Denver, Col.
 Lancaster Iron Works, Lancaster, Pa.
 Petroleum Iron Works Co., Sharon, Pa.
 Tippet & Wood, Phillipsburg, N. J.

PIPE, SPIRAL RIVETED

*Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
 Abendroth & Root Mfg. Co., Newburgh, N. Y.
 American Spiral Pipe Works, Chicago, Ill.

PIPE STEEL

*East Jersey Pipe Co., New York.
 National Tube Co., Pittsburgh, Pa.
 Youngstown Sheet & Tube Co., Youngstown, O.

PIPE, WOOD

*American Wood Pipe Co., Tacoma, Wash.
 *Continental Pipe Mfg. Co., Seattle, Wash.
 *Pacific Tank & Pipe Co., San Francisco, Cal.
 *Redwood Mfrs. Co., San Francisco, Cal.
 Michigan Pipe Co., Bay City, Mich.
 Standard Wood Pipe Co., Williamsport, Pa.
 Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE, WROUGHT IRON

Byers Co., A. M., Pittsburgh, Pa.
 Reading Iron Co., Reading, Pa.

PIPE COVERING

*Carey Co., Philip, Cincinnati, O.
 *Continental Pipe Mfg. Co., Seattle, Wash.
 *Redwood Mfrs. Co., San Francisco, Cal.
 Johns-Manville, Inc., New York.
 Keasbey & Mattison Co., Ambler, Pa.
 Michigan Pipe Co., Bay City, Mich.
 Pacific Tank & Pipe Co., San Francisco, Cal.
 Standard Wood Pipe Co., Williamsport, Pa.
 Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE CUTTERS. (See Cutters, Pipe, Hand.)

PIPE FITTINGS

*Builders Iron Fdry, Providence, R. I.
 *Central Foundry Co., New York.
 *Crane Co., Chicago, Ill.
 *U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
 American C. I. Pipe Co., Birmingham, Ala.
 Clow & Sons, J. B., Chicago, Ill.
 Lunkenheimer Co., Cincinnati, O.
 Warren Fdry. & Mach. Co., New York.
 Wood & Co., R. D., Philadelphia, Pa.

PIPE HANDLING MACHINERY

*Mueller Mfg. Co., H., Decatur, Ill.
 Taylor Portable Steel Derrick Co., Chicago, Ill.

PIPE JOINT COMPOUND, SEWER

*Carey Co., Philip, Cincinnati, O.
 *Waring-Underwood Co., Philadelphia, Pa.
 Dixon Crucible Co., J., Jersey City, N. J.
 Leadite Company, Inc., Philadelphia, Pa.
 Pacific Flush Tank Co., Chicago, Ill.
 Ruberoid Co., New York.

PIPE JOINT MATERIAL, CAST IRON

Lead-Hydro-Tite Co., Boston, Mass.
 Leadite Co., The, Philadelphia, Pa.
 United Lead Co., New York.

PLOWS, CONTRACTORS

*Burch Plow Works Co., Crestline, O.
 *Holt Mfg. Co., Peoria, Ill.
 *Marion Steam Shovel Co., Marion, O.
 American Steel Scraper Co., Sidney, O.
 Case Threshing Machine Co., J. I., Racine, Wis.
 Deere & Co., Moline, Ill.
 Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
 International Harvester Co., Chicago, Ill.
 Moline Plow Co., Moline, Ill.
 Oliver Chilled Plow Works, South Bend, Ind.
 Russell Grader Mfg. Co., Minneapolis, Minn.
 Sidney Steel Scraper Co., Sidney, O.
 Western Wheeled Scraper Co., Aurora, Ill.
 Ward Plow Co., Batavia, N. Y.

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For Heating and Applying under Pressure all varieties of Bituminous Materials, Hot or Cold, for Road Construction, Maintenance or Dust Laying.

Heat and volume under instant control of operator. Positive pressure produced by the Kinney Pump.

PATENT COMBINATION Auto Heater and Distributor

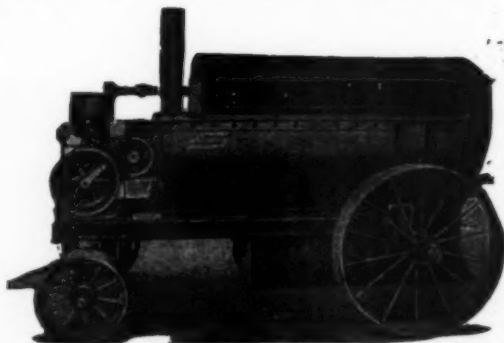


HANDY HEATER and SPRAYER

Especially adapted for Road maintenance, construction and general repair work. Contents constantly agitated while heating.

No burning or coking of material. Pump, Piping, Hose, Nozzles, Automatically Heated.

No Steam Required.



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- *Crane Co., Chicago, Ill.
- *Mueller Mfg. Co., H., Decatur, Ill.
- Clow & Sons, J. B., Chicago, Ill.
- Glauber Brass Mfg. Co., Cleveland, O.
- Rundle-Spence Mfg. Co., Milwaukee, Wis.
- United Brass Mfg. Co., Cleveland, O.
- Walworth Mfg. Co., Boston, Mass.

POLES, STEEL STRUCTURAL

- *Electric Railway Equipment Co., Cincinnati, O.
- *Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
- Blaw-Knox Co., Pittsburgh, Pa.

PORTABLE BUILDINGS

- *Littleford Bros., Cincinnati, Ohio.
- *Truscon Steel Co., Youngstown, O.
- Blaw-Knox Co., Pittsburgh, Pa.
- Pruden Co., C. D., Baltimore, Md.

PORTABLE STEEL DERRICKS. (See derricks, Steel Portable.)

PORTLAND CEMENT. (See Cement.)

POWDER. (See Explosives.)

PUMPS, AIR LIFT

- *Indiana Air Pump Co., Indianapolis, Ind.
- Advance Pump & Compr. Co., Battle Creek, Mich.
- American Steam Pump Co., Battle Creek, Mich.
- Cameron Steam Pump Works, A. S., New York.
- Ingersoll-Rand Co., New York.
- Sullivan Machinery Co., Chicago, Ill.
- Union Steam Pump Co., Battle Creek, Mich.
- Worthington Pump & Mch. Corp., New York.

PUMPS, BOILER FEED

- *Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- *Dayton-Dowd Co., Quincy, Ill.
- *Fairbanks, Morse & Co., Chicago, Ill.
- *Indiana Air Pump Co., Indianapolis, Ind.
- *Lea-Courtenay Co., Newark, N. J.
- Advance Pump & Compr. Co., Battle Creek, Mich.
- Buffalo Steam Pump Co., Buffalo, N. Y.
- Cameron Steam Pump Works, A. S., New York.
- Dean Bros. Steam Pump Wks., Indianapolis, Ind.
- De Laval Steam Turbine Co., E. Tretton, N. J.
- Deming Co., Salem, O.
- Gardner Governor Co., Quincy, Ill.
- Goulds Mfg. Co., Seneca Falls, N. Y.
- Midwest Engine Co., Indianapolis, Ind.
- Morris Machine Works, Baldwinville, N. Y.
- Murray Iron Works Co., Burlington, Ia.
- Scranton Pump Co., Scranton, Pa.
- Vogt Bros. Mfg. Co., Louisville, Ky.
- Warren Steam Pump Co., Warren, Mass.
- Weinman Pump Mfg. Co., Columbus, O.
- Yeomans Bros. Co., Chicago, Ill.

PUMPS, CENTRIFUGAL

- *Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- *American Well Works, Aurora, Ill.
- *Dayton-Dowd Co., Quincy, Ill.
- *Fairbanks, Morse & Co., Chicago, Ill.
- *Indiana Air Pump Co., Indianapolis, Ind.
- Aurora Pump & Mfg. Co., Aurora, Ill.
- Barnes Mfg. Co., Mansfield, O.
- Camden Iron Works, Camden, N. J.
- Cameron Steam Pump Works, A. S., New York.
- Clark Co., H. W., Mattoon, Ill.
- De Laval Steam Turbine Co., Trenton, N. J.
- Domestic Eng. & Pump Co., Shippensburg, Pa.
- Erie Pump & Engine Works, Medina, N. Y.
- Goulds Mfg. Co., Seneca Falls, N. Y.
- Keystone Driller Co., Beaver Falls, Pa.
- Lea-Courtenay Co., Newark, N. J.
- Manitowish Iron Wks., Manitowish, Mich.
- Midwest Engine Co., Indianapolis, Ind.
- Morris Machine Works, Baldwinville, N. Y.
- Schramm & Son, Inc., Chris. D., Philadelphia, Pa.
- United Iron Works, Kansas City, Mo.
- Wheeler Condenser & Eng. Co., Carteret, N. J.
- Worthington Pump & Mch. Corp., New York.
- Yeomans Bros. Co., Chicago, Ill.

PUMPS, CONTRACTORS'

- *Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- *American Well Works, Aurora, Ill.
- *Dayton-Dowd Co., Quincy, Ill.
- *Fairbanks, Morse & Co., Chicago, Ill.
- *Novo Engine Co., Lansing, Mich.
- *Standard Scale & Supply Co., Pittsburgh, Pa.
- Barnes Mfg. Co., Mansfield, O.

- C. H. & E. Mfg. Co., Milwaukee, Wis.
- Cameron Steam Pump Works, A. S., New York.
- Construction Mach'y Co., Waterloo, Ia.
- Deming Co., Salem, Ohio.
- Domestic Engine & Pump Co., Shippensburg, Pa.
- Emerson Pump & Valve Co., Alexandria, Va.
- Erie Pump & Engine Works, Medina, N. Y.
- Goulds Mfg. Co., Seneca Falls, N. Y.
- Lea-Courtenay Co., Newark, N. J.
- McGowan Co., J. H., Cincinnati, O.
- Midwest Engine Co., Indianapolis, Ind.
- Morris Machine Works, Baldwinville, N. Y.
- New York Eng. Co., New York.
- Pulsometer Steam Pump Co., New York.
- Schramm & Son, Inc., Chris. D., Philadelphia, Pa.
- Smith Co., T. L., Milwaukee, Wis.
- Universal Motor Co., Oshkosh, Wis.
- Van Noyhuys Machine Wks., Albany, N. Y.
- Waldo Bros. & Bond Co., Boston, Mass.

PUMPS, DEEP WELL

- *American Well Works, Aurora, Ill.
- *Fairbanks, Morse & Co., Chicago, Ill.
- *Indiana Air Pump Co., Indianapolis, Ind.
- *Nordberg Mfg. Co., Milwaukee, Wis.
- Aldrich Pump Co., Allentown, Pa.
- Cameron Steam Pump Works, A. S., New York.
- Clark Co., H. W., Mattoon, Ill.
- Cook, A. D., Lawrenceburg, Ind.
- Deming Co., Salem, O.
- Goulds Mfg. Co., Seneca Falls, N. Y.
- Keystone Driller Co., Beaver Falls, Pa.
- Layne & Bowler Co., Memphis, Tenn.
- Midwest Engine Co., Indianapolis, Ind.
- United Iron Works, Kansas City, Mo.
- Weber Subterranean Pump Co., New York.

PUMPS, DREDGING

- *Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- *American Well Works, Aurora, Ill.
- Aldrich Pump Co., Allentown, Pa.
- Buffalo Steam Pump Co., Buffalo, N. Y.
- Cameron Steam Pump Wks., A. S., New York.
- Domestic Eng. & Pump Co., Shippensburg, Pa.
- Morris Machine Works, Baldwinville, N. Y.
- Rumsey Pump Co., Ltd., Seneca Falls, N. Y.
- Wood & Co., R. D., Philadelphia, Pa.
- Worthington Pump & Mch. Corp., New York.

PUMPS, GASOLINE AND OIL

- *Kinney Mfg. Co., Boston, Mass.
- Bowser & Co., S. F., Fort Wayne, Ind.
- Worthington Pump & Mach. Corp., New York.

PUMPS, POWER

- *Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- *Dayton-Dowd Co., Quincy, Ill.
- *Fairbanks, Morse & Co., Chicago, Ill.
- *Indiana Air Pump Co., Indianapolis, Ind.
- *Kinney Mfg. Co., Boston, Mass.
- *Koehring Machine Co., Milwaukee, Wis.
- *Nordberg Mfg. Co., Milwaukee, Wis.
- *Northern Fire Apparatus Co., Minneapolis, Min.
- Alamo Iron Works, San Antonio, Tex.
- American Steam Pump Co., Battle Creek, Mich.
- American Well Works, Aurora, Ill.
- Barnes Mfg. Co., Mansfield, O.
- De Laval Steam Turbine Co., Trenton, N. J.
- Deming Co., Salem, O.
- Domestic Eng. & Pump Co., Shippensburg, Pa.
- Gardner Governor Co., Quincy, Ill.
- Gilbert & Barker Mfg. Co., Springfield, Mass.
- Goulds Mfg. Co., Seneca Falls, N. Y.
- Lawrence Machine Co., Lawrence, Mass.
- Lea-Courtenay Co., Newark, N. J.
- McGowan Co., J. H., Cincinnati, O.
- Weinman Pump Mfg. Co., Columbus, O.
- Worthington Pump & Mach. Corp., New York.
- Yeomans Bros. Co., Chicago, Ill.

RAILS AND RAIL JOINTS

- *Easton Car & Constn. Co., New York.
- *Koppel Indus. Car & Equip. Co., Koppel, Pa.
- Bethlehem Steel Co., Bethlehem, Pa.
- Cambria Steel Co., Philadelphia, Pa.
- Carnegie Steel Co., Pittsburgh, Pa.
- Hirsch Rolling Mill Co., St. Louis, Mo.
- Lackawanna Steel Co., Buffalo, N. Y.
- Sweet's Steel Co., Williamsport, Pa.
- Zelnicker Supply Co., W., St. Louis, Mo.

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IT'S GOOD FOR WHAT AILS YOUR ROADS

Take a scarifier that does not turn up its teeth at the hardest surface, add a grader blade directly behind it to finish the job in one operation, put both on a grader frame strong enough to stand the gaff—and you have

THE AUSTIN RIP-SNORTER

Improved roads that have gone to the bad are a nightmare to travelers and a tough problem for those charged with keeping them in repair.

No lasting good will result unless these worn-out, ravelled, pot-holed roads are first scarified, then graded and finally rolled—a lengthy and expensive job if each operation is done separately.

The Rip-Snorter is the ideal machine for such work. It scarifies and grades at the same time, saving time, labor, and expense.

Many other uses are constantly being found for the Rip-Snorter. For instance, it is A-1 for removing an old road surface preparatory to laying a more improved type. The old material is scarified and piled along the roadsides where it can be used to form the shoulders of the new road, or if this is not desirable, easily loaded into wagons.

Special Rip-Snorter Bulletin F should be in your files.

THE AUSTIN-WESTERN ROAD MACHINERY CO. CHICAGO

BRANCHES IN 22 CITIES



Buffalo-Pitts and Kelly-Springfield Rollers—Steam and Motor



All Types and Sizes

With or without Scarifier attachment.

Helps you finish the job on time.

No breakdowns—no trouble.

Send for catalog A for complete information.

THE BUFFALO-SPRINGFIELD ROLLER CO. SPRINGFIELD -:- OHIO

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- *Byers Machine Co., J. F. Ravenna, O.
- *Marion Steam Shovel Co., Marion, O.
- *Thew Shovel Co., Lorain, O.
- American Hoist & Derrick Co., St. Paul, Minn.
- Austin Machinery Corp'n, Chicago, Ill.
- Ball Engine Co., Erie, Pa.
- Buckeye Traction Ditcher Co., Findlay, O.
- Osgood Co., Marion, O.
- Parsons Co., Newton, Ia.

RECORDERS, WATER STAGE

- *Builders Iron Fdry., Providence, R. I.
- Gurley, W. & L. E., Troy, N. Y.

REINFORCING CONCRETE. (See Concrete Reinforcements.)

RIVETERS, PNEUMATIC

- Alliance Machine Co., Alliance, O.
- Chicago Pneumatic Tool Co., New York.
- Cleveland Pneumatic Tool Co., Cleveland, O.
- Hanna Eng. Works, Chicago, Ill.
- Helwig Mfg. Co., St. Paul, Minn.
- Independent Pneumatic Tool Co., Chicago, Ill.
- Ingersoll-Rand Co., New York.
- Watson-Stillman Co., New York.

RIVETS, BRIDGE AND STRUCTURAL. (See Bolts, Nuts, Etc.)

ROAD OILS. (See Oils, Road.)

ROAD OILERS

- *Austin-Western Road Mch. Co., Chicago, Ill.
- *Connerly & Co., Philadelphia, Pa.
- *Good Roads Machinery Co., Philadelphia, Pa.
- *International Motor Co., New York.
- *Kinney Mfg. Co., Boston, Mass.
- *Littleford Bros., Cincinnati, Ohio.
- *Universal Road Mch. Co., Kingston, N. Y.
- *White Co., Cleveland, O.
- Autocar Co., Ardmore, Pa.
- Etnyre & Co., E. D. Oregon, Ill.
- Four Wheel Drive Auto Co., Clintonville, Wis.
- Huber Mfg. Co., Marion, O.
- Selden Truck Corp'n, Wabash, Ind.
- Service Motor Truck Co., Wabash, Ind.

ROAD AND PAVING ROLLERS

- *Austin-Western Road Mch. Co., Chicago, Ill.
- *Barber Asphalt Paving Co., Philadelphia, Pa.
- *Buffalo Springfield Roller Co., Springfield, O.
- *Good Roads Machinery Co., Philadelphia, Pa.
- Cass Threshing Machine Co., J. I., Racine, Wis.
- Erie Machine Shops, Erie, Pa.

ROAD AND STREET MACHINERY

- *Acme Road Machinery Co., Frankfort, N. Y.
- *Austin-Western Road Mch. Co., Chicago, Ill.
- *Baker Mfg. Co., Springfield, Ill.
- *Barber Asphalt Paving Co., Philadelphia, Pa.
- *Bay City Dredge Works, Bay City, Mich.
- *Buffalo Springfield Roller Co., Springfield, O.
- *Connerly & Co., Inc., Philadelphia, Pa.
- *Good Roads Machinery Co., Philadelphia, Pa.
- *Holt Mfg. Co., Peoria, Ill.
- *Kinney Mfg. Co., Boston, Mass.
- *Kochring Machine Co., Milwaukee, Wis.
- *Koppel Ind. Car & Equipment Co., Koppel, Pa.
- *Littleford Bros., Cincinnati, O.
- *Universal Road Mch. Co., Kingston, N. Y.
- Adams & Co., J. D., Indianapolis, Ind.
- Aultman & Taylor Mach. Co., Mansfield, Ohio.
- Austin Machinery Corp'n, Chicago, Ill.
- Avery Co., Peoria, Ill.
- Erie Machine Shops, Erie, Pa.
- Gallon Iron Wks. & Mfg. Co., Gallon, Ohio.
- Hais Mfg. Co., Geo., New York.
- Honhorst Co., Joe., Cincinnati, O.
- Lakewood Engineering Co., Cleveland, O.
- Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
- Russell Grader Mfg. Co., Minneapolis, Minn.
- Smith & Sons Mfg. Co., Kansas City, Mo.
- Smith Co., T. L., Milwaukee, Wis.
- United Iron Works, Kansas City, Mo.

ROCK CRUSHERS AND PULVERIZERS

- *Acme Road Machinery Co., Frankfort, N. Y.
- *Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- *Austin-Western Road Mch. Co., Chicago, Ill.
- *Good Roads Machinery Co., Philadelphia, Pa.
- *Universal Road Machinery Co., Kingston, N. Y.
- Chalmers & Williams, Inc., Chicago Heights, Ill.
- Fuller Lehigh Co., Fullerton, Pa.
- Gallon Iron Works Mfg. Co., Gallon, O.

- Guendler Pat. Crusher & Pulv. Co., St. Louis, Mo.
- Jeffrey Mfg. Co., Columbus, O.
- Link Belt Co., Philadelphia, Pa.
- McLanahan-Stone Mch. Co., Hollidaysburg, Pa.
- Raymond Bros. Impact Pulv. Co., Chicago, Ill.
- Smith Eng. Works, Milwaukee, Wis.
- Traylor Eng. & Mfg. Co., Allentown, Pa.
- Williams Patent Crusher & Pulv. Co., Chicago, Ill.
- Worthington Pump & Machy. Corp., New York.

ROCK DRILLS. (See Drills, Rock)

ROOFING, ASPHALT, COMPOSITION, TILE, ETC.

- *Barber Asphalt Paving Co., Philadelphia, Pa.
- *Barrett Co., New York.
- *Carey Mfg. Co., Philip, Cincinnati, O.
- *Standard Oil Co. of Indiana, Chicago, Ill.
- *Texas Co., New York.
- American Cement Tile Mfg. Co., Pittsburgh, Pa.
- Atlantic Refining Co., Philadelphia, Pa.
- Bird & Son, E. Walpole, Mass.
- Edwards Mfg. Co., Cincinnati, O.
- Flinthote Co., Boston, Mass.
- Johns-Manville, Inc., New York.
- Keystone Roofing Mfg. Co., York, Pa.
- Lehon Co., The, Chicago, Ill.
- National Roofing Co., Tonawanda, N. Y.
- Ruberoid Co., New York.
- Sall Mountain Co., Chicago, Ill.
- Sifo Products Co., St. Paul, Minn.
- Sonneborn & Sons, Inc., L., New York.
- United States Gypsum Co., Chicago, Ill.
- Western Elastier Roofing Co., Denver, Colo.

ROOFING, METAL

- *Truscon Steel Co., Youngstown, O.
- American Rolling Mill Co., Middletown, Ohio.
- Berger Mfg. Co., Canton, O.
- Edwards Mfg. Co., Cincinnati, O.
- National Metal Roofing Co., Jersey City, N. J.
- Stark Rolling Mill Co., Canton, O.

ROOFING KETTLES. (See Kettles)

ROPE, MANILA

- American Mfg. Co., Brooklyn, New York.
- Columbian Rope Co., Ashburn, N. Y.
- Cupples Cordage Co., Brooklyn, N. Y.
- Hooven & Allison Co., Xenia, O.
- Kelly Co., R. A., Xenia, O.
- New Bedford Cordage Co., New Bedford, Mass.
- Peoria Cordage Co., Peoria, Ill.
- Plymouth Cordage Co., N. Plymouth, Mass.
- Wall Rope Wks., New York.
- Waterbury Co., New York.
- Whitlock Cordage Co., New York.

ROPE, WIRE, HOISTING, HAULAGE

- American Steel & Wire Co., Chicago, Ill.
- Broderick & Bascom Rope Co., St. Louis, Mo.
- Leschen & Sons Rope Co., A., St. Louis, Mo.
- MacWhyte Co., Kenosha, Wis.
- Moon Co., Geo. O. Garwood, N. J.
- Roehling's Sons Co., J. A., Trenton, N. J.
- Upson-Walton Co., Cleveland, O.
- Waterbury Co., New York.
- Wickwire Spencer Steel Corp., Worcester, Mass.
- Williamsport Wire Rope Co., Williamsport, Pa.

RULES, FOLDING

- Kolesch & Co., N. Y. C.
- Lufkin Rule Co., Saginaw, Mich.

SASH, BOLLED STEEL. (See Window Frames and Sash)

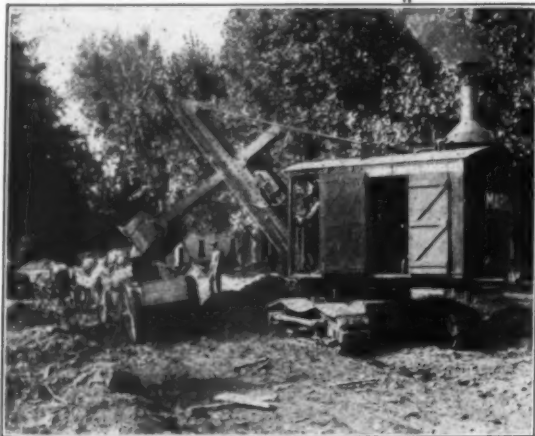
SAW RIGS, PORTABLE

- *Knickerbocker Co., Jackson, Mich.
- *Ransome Concrete Mach. Co., Dunnellen, N. J.
- *Standard Scale & Supply Co., Pittsburgh, Pa.
- C. H. & E. Mfg. Co., Milwaukee, Wis.
- Oshkosh Mfg. Co., Oshkosh, Wis.

SCARIFIERS

- *Acme Road Machy. Co., Frankfort, N. Y.
- *Austin Western Road Mch. Co., Chicago, Ill.
- *Barber Asphalt Paving Co., Philadelphia, Pa.
- *Buffalo Springfield Roller Co., Springfield, O.
- *Good Roads Machinery Co., Philadelphia, Pa.
- *Universal Road Mch. Co., Kingston, N. Y.
- Adams & Co., J. D., Indianapolis, Ind.
- Gallon Iron Works & Mfg. Co., Gallon, O.
- Huber Mfg. Co., Marion, O.
- Lyle Cul. & Rd. Equip. Co., Minneapolis, Minn.
- Russell Grader Co., Minneapolis, Minn.

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Contractors want the shovel that will dig the most dirt in the least possible time. The Marion "21" with its inbuilt ruggedness and its ease of handling will keep the wagons or trucks loaded and on the move—demonstrating Marion *quality* and *dependability* through *service*.

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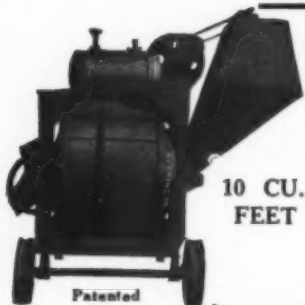
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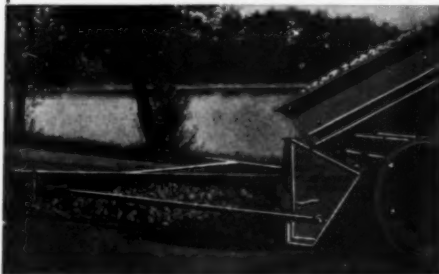
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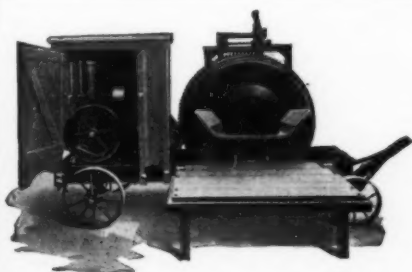
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 OF CONSTRUCTION MATERIALS AND EQUIPMENT

Published Monthly at 154 Nassau St., New York, by The Civic Press, Inc.
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Vol. III

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Cletrac Speeds Golf Course Work

SIX Cletracs are taking the place of thirty teams on this big golf course job. One is clearing out 15 rods of 25' saplings along a fence without the aid of a grubbing tool. Another is plowing the ground for fairways. Two are scraping down a knoll. One is building up a knoll, and another is leveling and pulverizing the soil on the finished green.

The contractor in charge says, "Cletrac is the only tractor for our work. It goes anywhere and does lots of work that had to be done by hand before."

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Contractors' & Engineers' Monthly

Vol. III, No. 2

New York, N. Y.

August, 1921

Fire-Safe Roofs for Suburban Homes

Use of Prepared Types of Shingles Now Permitted by Fire Regulations

By **Prévost Hubbard**

Chemical Engineer, Asphalt Association

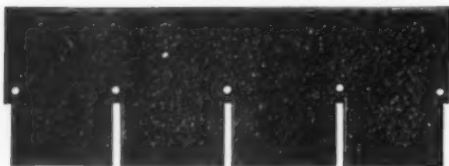
NO building is more weather-proof or fire-safe than its roof. Any structure that is roofed with materials susceptible to fire or weather conditions is not only an uncertain investment, but an actual menace to health and life. Fire plots its course from one inflammable roof to another, and unless there are roofs that raise a barrier

to the progress of the flames, the property owners of the neighborhood are carrying a big fire risk, and the buildings constitute a great menace to the community.

That a realization of these essential facts has been driven home in recent years to real estate dealers, housing experts, homeowners, architects and contractors, is shown



ONE OF A GROUP OF TWELVE HOMES IN THE LEIGHTON ADDITION TO FORT DODGE, IOWA,
ROOFED WITH BARRETT EVERLASTIC MULTI-SHINGLES



A STRIP OF GENASCO "SEALBAC" ASPHALT SHINGLES 10 INCHES DEEP BY 32 1/4 INCHES LONG, SHOWING POSITION FOR NAILING

by the tremendous increase in the production of patent roofing during the past twelve years as contrasted with the production of wood shingles in the same period. During this period patent roofing advanced from 8,200,000 squares in 1908 to 30,600,000 in 1919, while red cedar shingles slumped from 8,700,000 to 7,400,000 squares. The roofer's square equals 100 square feet.

There are in the United States over forty factories engaged in the manufacture of asphalt shingles and prepared roofing, representing with their allied interests an investment of more than \$150,000,000. It has been conservatively estimated that the daily output of these factories exceeds 7,500,000 square feet of finished material. This daily output, if rolled into one sheet 3 feet wide, would stretch from Chicago to Buffalo, a distance of more than 500 miles, and would be sufficient to roof 4,000 dwellings of average size. This material is shipped not only to all parts of the United States, but to South America, Mexico, China, Italy, Austria, Germany, England and Russia.

Twenty-five years ago comparatively small quantities of asphalt roofing were manufactured. Many roofs of this material, however, have lasted for over 20 years, and asphalt shingles are now generally guaranteed for a period of 10 years. Time has demonstrated the durability of asphalt and its propensity to "stay alive" and not to harden unduly through loss of volatile oils. As compared with other bituminous roofings, it shows less softening in hot weather and more pliability during cold weather. Contraction and expansion under changing weather conditions have been found to give practically no trouble, and there is little danger of cracking and breaking. The introduction of asphalt into the manufacture of prepared shingles has made possible the rapid advance in the use of the new roofings.

How the Shingles Are Made

Asphalt shingles are usually manufactured of rag or asbestos felt, thoroughly saturated with asphalt. On top of this is placed a heavy coating of harder asphalt, which thoroughly waterproofs the shingle and into which, while hot, is rolled mineral matter, such as crushed slate or feldspar, colored green, gray, red or brown, as desired. This roofing is much less inflammable than the wooden shingle, and its use is now permitted in restricted districts in which wood shingles are prohibited by the fire regulations.

When an asbestos felt is used in the manufacture of asphalt shingles, they are extremely fire-resistant and "non-combustible," and take the same rate of insurance as slate, metal and tile. Slate weighs from 650 to 800 pounds per 100 square feet, while tile weighs between 950 and 1,200 pounds. The asphalt shingles average 220 pounds per 100 square feet, or about the same weight as that of wooden shingles. Prepared roofing in rolls varies from 35 to 100 pounds. The asphalt shingles wear for 10 to 15 years and do not curl or "lift up," blow off the roof or flap in the wind.

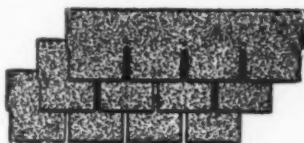
Many of the more important cities and towns in this country now require fire-resisting roofing within their fire limits. Among these are Birmingham and Montgomery, Ala.; Wilmington, Del.; Jacksonville and Tampa, Fla.; Augusta, Columbus and Savannah, Ga.; New Orleans, La.; Cambridge, Chelsea, Fall River, Lawrence, Lexington, Lynn, Newton, Salem and Somerville, Mass.; Hoboken, Jersey City, Newark, Paterson, Perth Amboy and Trenton, N. J.; Allentown, Easton and Reading,



SHOWING THE "SEALBAC" FEATURE OF BARBER GENASCO ASPHALT SHINGLES

Pa.; Charleston, S. C.; El Paso and Paris, Tex.; Norfolk and Portsmouth, Va.

From pioneer days the graceful, free lines of a shingle roof have been so intimately associated with the architecture of American houses that the shingle roof can almost be called the national roof for the American home. No other roof construction offers so many varied effects or permits such artistic treatment as the shingle. The new home not only merits a roofing that will enhance its architectural beauty, but should also have protection from fire, and permanence under variable weather conditions. This is made possible by the asphalt shingle. With a liberal field from which to make selections of color, shape and methods of application, a roof of artistic appearance, as well as of long durability, can be chosen by the home-builder or his architect, from among the many types of asphalt shingles and other prepared asphalt roofings. These sheet roofings are manufactured from woven or felted fabric saturated and coated with asphalt. They may be obtained either in flat sheets or rolls of suitable length, and of single- or multiple-ply fabric, according to the requirement of cost and durability. Some of the sheet roofings are surfaced with mineral matter such as sand, gravel, talc, slate and feldspar; some are manufactured with a laminated surface; and some to imitate shingle structures of various designs. Many of these decorative roofings



METHOD OF LAYING EVERLASTIC ASPHALT SHINGLES

have become very popular in recent years and are less expensive than shingles.

"Roofing" constitutes an important branch of a much broader field of engineering, known as "waterproofing," in which asphalt has for thousands of years played an important part. The ancient Egyptians were able to preserve their mummies in good condition to the present day by wrapping them in fabric saturated and made waterproof and weather-resisting with asphalt. Modern ingenuity has discovered no material better adapted to waterproofing and preserving its present-day structures than asphalt. It is not surprising, therefore, that, as in recent years, the production of asphalt in large quantities has been rendered possible by refining crude petroleum. Its use for roofing and waterproofing has developed rapidly. In many structures, from roof to cellar, asphalt plays an important part, first as roofing, then as sheathing and insulating, and finally as a waterproofing membrane for the underground portion of the structure it is used to protect.

Reservoir Waterproofing

WHERE an economical type of construction is desired, and the ability to withstand great hydrostatic pressure is not essential, a mopping of Genasco Positive Seal Asphalt "B" has worked out very successfully when applied over concrete which previously had been primed with Genasco asphalt primer.

Several reservoirs of the Great Western Sugar Company at its various plants in Colorado and Nebraska have been effectively waterproofed, using Positive Seal "B" applied over concrete which had been given a priming coat of asphalt primer.

A brief resumé of these installations will give some definite information on this particular type of application.

The reservoirs in question were very large, one being 800 feet square and 30 feet deep, and the slopes $2\frac{1}{2}$ to 1. The concrete was poured in slabs 10 feet square, over a concrete sill. The surface of this sill was primed and then a mopping of Positive Seal "B" $\frac{1}{8}$ -inch

thick was applied. The concrete for the slab was then poured, and when it had dried out and become thoroughly set, the edges of the joints were primed and the spaces between the 10-foot slabs were filled with Positive Seal "B" for expansion joints.

The surface of the slabs for the slopes was primed, and after this had become thoroughly dry, a mopping of Positive Seal "B" approximately $\frac{1}{8}$ -inch thick was applied. This procedure also was followed for the slabs constituting the bottom of the reservoir.

The water level in these reservoirs was not constant, dropping to a very low point during summer months, but rising to a capacity point during the winter. The head of water withstood by this method was 13.02 pounds pressure to the square inch. These reservoirs have been installed four years or longer.

Genasco mastic also has been used for waterproofing reservoirs. Some objections have been made on account of its dark color, and as a

consequence it is general practice after the mastic has been applied to go over it with a finish cement coat. Mastic also is used for waterproofing between two layers of concrete, usually $\frac{1}{2}$ -inch thick, depending upon the type of construction, conditions to be encountered, and other factors.

Among the reservoirs in which Genasco mastic has been employed are those at the Belmont filtration plant, the Queen Lane pumping station, and the Oak Lane basin of the Philadelphia Bureau of Water. Genasco products are made by the Barber Asphalt Paving Company, Philadelphia, Pa.



THIS IS THE WAY THEY MAINTAIN ROADS IN PILOT GROVE TOWNSHIP, BURNSIDE, ILL.

A Tractor for Road Maintenance

THE illustration herewith shows the road maintainer owned by Pilot Grove Township, Burnside, Ill., which has operated for several years very successfully in maintaining the township roads. It has two 25-foot blades and a 30-foot spread.

During the early part of this season, J. D. Stidum has been hauling this maintainer with an Allis-Chalmers 18-30 tractor. This combination leveled 72 miles of road in $3\frac{1}{2}$ days on 110 gallons of gasoline. On one afternoon, May 4, 14 miles of road were leveled. There was never any trouble from lack of power,

even on the hills, some of which were pretty steep propositions. There was no trouble with the tractor's raising in front and it operated the leveler perfectly even on the turns.

C. B. Dorothy, Road Commissioner for Pilot Grove Township, stated that one of the features of this tractor which appealed to him particularly was that it had all the traction it needed in spite of its light weight. This is due in large measure to the traction wheels, which are equipped with special cleats to get the most out of every ounce of weight in the machine.

A Trained and Experienced Bidder

1. He should be one of the competitors or bidders who has successfully handled projects of a parallel nature, and is known to be a trained and experienced builder, and is thoroughly conversant with each and every part of the work, is personally able to direct each and every part of the work, and also determine the quality and admissibility of materials at sight.

2. He or they should be known to be absolutely honest, in disposition and purpose, with

an unbroken reputation for fair play, in its broadest sense, and game to the limit.

3. Select the bidders who possess the above qualifications, and they are the lowest responsible bidders irrespective of the terms or amount of the bid.

4. With such bidders accepted, the matter of bonds is a very minor consideration, as they are not necessary.

*Fred L. Broughton & Son, Alma, Mich.,
in A. G. C. Bulletin.*

Road-Construction Plants

By B. H. Piepmeier

Engineer of Construction, State of Illinois, Division of Highways

SUCCESSFUL road work offers more possibilities for different types of plants perhaps than any other single line of building construction, and every section of road to be built is a field for intensive study and investigation by the engineer and the contractor. A thorough examination of the road plants in operation for the past few years shows clearly the need of more careful study of plant problems than is ordinarily given by engineer or contractor.

A successful road contractor in Illinois states: "No equipment should be purchased by a contractor unless he has sufficient work in view to enable him to practically pay for the equipment with a reasonable profit." If this rule were followed by more contractors, on many jobs, there would undoubtedly be less equipment and more profit. Such a statement should in no way discourage the road contractor in equipping himself thoroughly to do economical road work, but should force him to make a more complete analysis of his job before he invests in a road-building plant.

Small Construction Unit Advantageous— Duplicate Units Desirable

In general, the building of a system of roads requires the installation of a number of small plants in preference to a few large plants. This has been particularly true in the past on account of (1) the contractor's inability to secure experienced and capable superintendents for handling large-plant operations; (2) railroad transportation falling short in the delivery of sufficient materials to keep large plants working efficiently; and (3) frequent breaking of the machinery required in large road-construction plants—the breakdown of one machine very often delaying the operations of the entire plant and causing undue

expense.

The small construction unit necessitates doing many operations by hand at somewhat greater expense than if done with machinery; however, when the final analysis is made, the small unit will show considerable efficiency on account of the possibility of its operating many times independently of any one particular machine out of service through breakdown.

Conditions existing during the past few years have made it impossible for the contractor with a large plant layout to show a fair profit. As soon as labor and transportation conditions become more stabilized, the large plant will show a much greater efficiency.

Contractors must give considerably more thought to the design of road plant so that its successful operation may not be wholly dependent upon one piece of machinery. Many successful road contractors realize already that to insure a constant and uniform output it is economy in many instances to duplicate machines. Some contractors have installed a duplicate pumping system for the water-supply, which is vital to the successful and economical operation of the road plant, and the additional cost of the duplicate unit is small compared to the advantage of being able to operate the plant without a delay.



MATERIAL YARD, SHOWING THE ARRANGEMENT OF LOADING BINS AND STORAGE PILE



MATERIAL YARD, SHOWING ARRANGEMENT OF LOADING BINS AND STORAGE PILES WHEN STIFF-LEG DERRICKS ARE USED

In many instances duplicating concrete mixers has prevented a complete shut-down of operations. The average road job may not always justify a duplication of the mechanical units; but where a large season's work is required, a serious investigation of the advantage of the duplicate units should be made.

Transportation of Materials

The transportation problem in road building is one of the most important factors in the economical construction of roads. Consequently, this part of the plant operation should be given a great deal of study. The transportation cost should not only be estimated on the basis of the ton-mile cost, but the effect it may have on the cost of operation of the remainder of the construction plant should be taken into consideration. Hauling cost varies from 20 to 40 cents per ton-mile. In a season's work a saving therefore, of but a few cents per ton-mile may amount to several thousand dollars. The actual hauling costs may be exceedingly low, yet if the delivery affects the maximum output of the remainder of the plant, the inefficiency should naturally be charged against transportation cost.

Inasmuch as most specifications now prohibit storing road materials

upon the sub-grade, the road contractor is compelled to provide for transportation in one of two ways. He must deliver materials from his material yard to the road by industrial-railroad equipment or by truck. The industrial equipment, while expensive in first cost, will enable the contractor to complete his work with a minimum amount of trouble under normal conditions, and regardless of weather, the average industrial equipment will insure a more uniform delivery of materials than any other unit that may be used. The chief objection to the industrial unit is that it is limited to road construction with grades ordinarily less than 4 per cent and a minimum number of railroad crossings. Further objection would be that the high initial cost demands that a large mileage of roads be built each year in order to absorb the interest on the investment and the depreciation.

The other method of delivery is by truck or team. In recent years truck delivery has superseded team delivery, being more rapid and delivering material to a paving mixer or from a mixer direct to the road with less disturbance to the road-bed. Truck transportation of road materials is very flexible and therefore suited to more different sections of work than perhaps any other method of transportation. It is es-



FOUR-BAG BATCH OF MATERIALS DELIVERED AND DUMPED DIRECTLY INTO SKIP OF MIXER

pecially suited to the delivery of mixed concrete from a central plant to the road being improved, and to the delivery of proportional batches direct to the paving mixer or to a point at which the batch boxes may be transferred to a short industrial line, which in turn delivers them to the paving mixer.

Delivery of Concrete from Central Mixing Plant

During the past few years the delivery of mixed concrete from a central mixing plant direct to the job has been attracting considerable attention. This method is worthy of study, as it enables the contractor to centralize operations and in many instances to economize in plant and operating expenses. The central mixing plant should be reasonably uniform in design and simple in operation. A study of the central mixing plant in use during the past two years shows no two very similar in design. It would seem possible that unloading aggregate and cement from railroad cars, mixing the materials to the desired proportions and consistency, and turning out a mixed concrete, could be standardized to such an extent that central plants could be simplified and made more economical in operation. It is hoped that the mechanical engineer and the equipment designer will assist in the design of a practical and economical central mixing plant unit.



CENTRAL MIXING PLANT, SHOWING MATERIAL STORAGE



THREE-TON TRUCKS USED FOR DELIVERY OF MIXED CONCRETE FROM CENTRAL MIXING PLANT

Although central mixing plants may be fairly uniform in design, the delivery of the concrete from the plant to the road will vary considerably to suit the existing local conditions. Mixed concrete may be delivered by industrial equipment, provided the hauls are reasonably short and the equipment is designed for small loads with considerable speed in transportation. The small pneumatic-tired truck will usually prove the most efficient machine for delivery of mixed concrete, taking the individual batch of mixed concrete direct from the mixer to the road being improved, in the least possible time.

Use of the Pneumatic-Tired Truck

The pneumatic-tired truck is essential when speed is an important factor in delivery and where it is necessary to do considerable hauling over the subgrade. This truck will usually reduce the load on the subgrade to less than 125 pounds per square inch of surface, and this pressure, even though frequently applied, does not seriously injure or displace a prepared subgrade having average conditions.

It is true that it is practically impossible to deliver materials over earth roads with trucks when the roads are muddy or during rainy periods. However, the road may be materially improved and

the truck used practically the entire construction season if the road is constantly maintained by the use of the road drag and given an application of half a gallon of oil per square yard of surface early in the construction season.

The light pneumatic-tired truck may also be used for the delivery of proportioned batches of aggregates direct to the paving mixer on the road being improved. There are now on the market many types of batch boxes and dump bodies which permit the batches to be dumped directly into the skip of the paving mixer. This method has proved to be very satisfactory. It differs from the delivery of mixed concrete in that a paving mixer is used instead of a stationary building mixer, and most of the operations of the contractor are out where the road is actually being laid.

Improvements in Design of Equipment Desirable

The plant investment of the road contractor of to-day is entirely too expensive compared with the work accomplished during a single construction season or from one particular installation of a construction plant. From \$60,000 to \$100,000 worth of plant equipment is frequently set up to build less than 10 miles of highway. This is equivalent to charging off \$2,500 to \$3,000 for equipment against every mile of road built. It is doubtful whether there is any other building construction in which so much depreciation and interest on plant investment must be charged off on so small an amount of work. The mechanical engineer, the equipment designer, and the contractor should apparently spend more time in the design of road-construction plants in order to insure a greater output with less initial investment.

Many of our road-building machines are being made larger, more cumbersome, and more expensive each year. The fact that road-building machinery is subjected to more severe use than perhaps any other machinery used in building construction has induced the manufacturer to add to his equipment each year to insure more rigid construction. Many machines, such as the concrete paving mixer, can undoubtedly be completely redesigned and a machine produced much smaller in size, to mix more concrete and be less cumbersome on the job.

Mixer manufacturers have continued to improve the design of their paving mixers

by following the same principles of mixing that have been in use for many years. It seems absurd that we must have a concrete paver costing from \$8,000 to \$12,000 and weighing from 10 to 15 tons that will lay less than two miles of 18-foot concrete road in 30 days. It seems absurd also that we should still be using mixers that require 60 seconds of time for the mixing of aggregate and cement when it should be possible to do the same amount of mixing by some mechanical means in less than 15 seconds. If such a machine could be produced, a one-bag paver would turn out as much concrete as our present four-bag pavers. The present paver is also designed so that the mixing is concealed from the view of the mixer operator. This prevents absolutely the uniform consistency essential in securing a good concrete.

If the mixer designer can produce a smaller machine having a greater output per hour of operation and so designed that the consistency of the concrete produced can be controlled by the operator instead of by some unsatisfactory mechanical means, the results will be a wonderful aid to the road-building industry.

Also Room for Improvement in Railroad Equipment

It also seems possible that a very material improvement can be made in the present railroad transportation equipment. Practically all road contractors now unload aggregates from open-top cars by means of clam-shells. This method is not always the most economical; but the contractor is forced to use it, as he cannot secure all the hopper-bottom cars he might desire. On account of the large volume of road materials to be delivered by railroad cars, some type of car should be designed that would permit of more rapid unloading by more economical methods. If this is not done, it is hoped at least that open-top car manufacturers will improve the design of their cars and make them so that they can be more easily unloaded with clam-shell equipment. Not only would such improvement aid the individual unloading the car, but the railroad company would add to the life of its equipment.

Many open-top cars are now designed with projecting angles, rivets, bolts, braces, timbers, etc., which interfere with the efficient operation of the clam-shell. It is diffi-



A WELL-BUILT STREET IS AN ASSET TO BOTH THE CITY AND THE CONTRACTOR

cult to understand why railroad cars could not be designed so that the interior of the car would be perfectly smooth. In fact, it would be practicable and economical for all open-top cars to be built with a fillet having a radius of about 18 inches in the bottom angle at the ends of the car. The curved bottom angles would permit the cars to be emptied more rapidly and economically either with hand shovels or clam-shells.

Further investigation should also be made of the use of open-top removable batch boxes for railroad transportation of materials. While the substitution of standardized batch boxes for open-top cars would be a very radical departure from present equipment, the average construction plant could be designed to handle the boxes much more economically than the loose materials.

ACKNOWLEDGMENT.—Text and illustrations by courtesy of *Mechanical Engineering*, New York City.

Lack of Building Standards

By Herbert C. Hoover

United States Secretary of Commerce

I AM informed that from 10 to 20 per cent of the cost of building lies in the lack of standards in a broad sense. We have, for instance, 260-odd building codes to which a large portion of the building of the country must conform. They vary flagrantly in floor loads, wall thickness, stress requirements, character of material to be employed; they hold back progress in methods of construction; they make impossible the standardization and simplification of certain materials which could be

effected without affecting the attractiveness of design, of style, the arrangement of the interiors, or the usefulness of the buildings.

"We need a standardization and a simplification in many of the materials required. The dimensions of articles of constant use could be greatly simplified as to many construction materials, plumbing, hardware, etc., with great savings both in manufacture, distribution, and installation, and there need be no sacrifice of styles."

Emergency Bridge Construction

General Electric Company Rebuilds Bridge on Traffic Artery Near Boston, Mass., at Cost

CO-OPERATION plus electricity recently accomplished an engineering feat of the first order when a 400-foot section of the burned bridge across the Saugus River connecting Lynn and Revere, Mass., was rebuilt in the record time of 10 days.

Henry S. Baldwin, department engineer of the Lynn plant of the General Electric Company, is credited both with the inception of the plan and its subsequent execution, although due recognition is accorded both to the support furnished by R. H. Rice, plant manager, and the capable technical assistance rendered by other engineers. The undertaking is probably one of the most striking of its kind and shows how cities, officials, and industrial works pooled interest, cut red tape and met a real emergency.

The train of events leading up to this work started with a fire on June 17, which partly destroying the original structure



VIEW OF LYNN END OF SAUGUS RIVER BRIDGE, POINT OF PINES, MASS. AFTER DISASTROUS FIRE WHICH OCCURRED IN THE EARLY MORNING

across the Saugus River, known as the Point of Pines bridge. That fire broke a vital traffic artery. On the following day the Metropolitan District Commission announced that a new bridge would cost between \$60,000 and \$150,000 and that no funds were available. But in view of the fact that a \$50,000 state emergency fund existed, the Commission's engineers started drawing up specifications. On the 21st, Lynn, Revere, and the town of Swampscott asked the Commission for a temporary bridge.

A hearing was announced on the 23rd and held on the 30th. In the interim, the Commission's engineer had reported that to build a bridge costing \$150,000 would mean shutting off travel for six months. This suggestion of delay, with the summer heavy automobile travel just starting, worried Lynn and Revere not a little. On the 29th, the day before the Commission's hearing, the General Electric Company



VIEW TAKEN JULY 12, 1921 SHOWING CONDITION OF RECONSTRUCTION WORK, ALL BURNED PILES HAD EITHER BEEN PULLED AND REPLACED BY NEW ONES OR SPLICED AND EACH BENT HAS BEEN CAPPED

whose River Works are near the Lynn end of the bridge, offered to rebuild the bridge in temporary form at cost within 15 days. Engineers scoffed but Mr. Baldwin, who took charge of the entire job, was sure it could be done. That afternoon, he and John Trudinger, an assistant, went out in a rowboat and inspected the ruins. That night complete tentative plans and cost estimates were made.

The next day after the hearing, the Commission decided to let the General Electric Company go ahead. The city of Lynn appropriated \$40,000 to finance the work and Governor Cox gave assurance that the state would reimburse the city next winter when the Legislature meets.

Detailed plans were drawn July 2, the engineers finishing them in the small hours of the next morning, so that they could be given to contractors for bids. The W. S. Rendle Company of East Boston took the labor contract at \$14,200 and the General Electric Company agreed to furnish the materials and supervision for \$20,000.

On the morning of July 4, steam derricks appeared at the bridge and work started tearing off the damaged deck and weakened piles. Three days later new construction began. Storms and heart-breaking obstacles



VIEW TAKEN JULY 17, 1921 SHOWING MOTOR-DRIVEN SAW NEAR THE MIDDLE OF BRIDGE AND AT THE SIDE THE FLOODLIGHTS

interfered from the start. At first it looked like a month's job. Floodlights were put up and the work pushed ahead night and day. As days passed, the outlook grew brighter. By July 12, all the caps except on 6 spliced joints at the Lynn end of the bridge were in position. On the 14th it was possible to cross the bridge on the loose planking while the cross bracing went ahead swiftly.

When the job of laying the wearing surface of 2-inch spruce planks began, the workmen were sure that sawing would take ten days to two weeks. The General Electric Company rushed out an individually motor-driven circular saw table with mitering arrangements operated by two experts from the Lynn Works. The planks were cut at the proper angle as fast as they could be fed.

The laying of the planks was so swift that Mayor Creamer of Lynn was able to drive the last spike on the 18th and the bridge was done.

Only the best materials have been put into the structure. The new piles are of oak; the stringers, caps, deck, fence, post and hand rails are of long leaf hard pine and the wearing surface of spruce. In all 270,000 board feet of lumber have been used and thousands of bolts, made upon order at the General



VIEW OF THE COMPLETED BRIDGE...THE FLAG WAS RAISED JUST PRIOR TO THE OPENING OF THE BRIDGE AT 11.10 A. M. JULY 18, 1921, TEN DAYS AFTER ACTIVE BRIDGE CONSTRUCTION WAS COMMENCED

Electric plant, thereby saving time and money, will hold the whole together for years to come. The caps are 8 x 14 inches and the stringers 10 x 16, spanning joints. Instead of a temporary bridge, it is made as well if not better than the original structure and is guaranteed for ten years.

Following completion of the bridge Mr. Rice received this letter from Governor Cox of Massachusetts:

"I desire to add my expression of appreciation to those which have been so properly extended to the General Electric Company for the splendid public service rendered in replacing the Point of Pines Bridge so rapidly.

"It was a difficult situation, and the prompt and efficient way in which the General Electric Company met the public needs was most commendable.

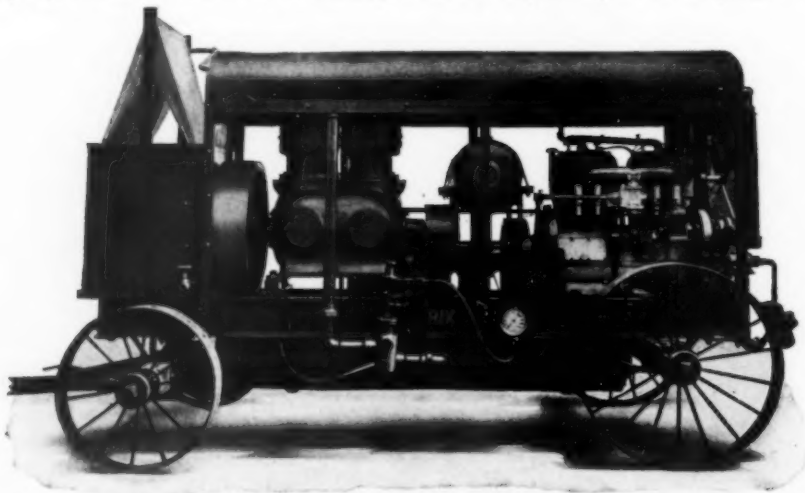
"May I in turn, through you, congratulate the engineers and workmen for their fine co-operation which has brought such credit to your organization."

Compressed-Air Equipment for Road Work

FREQUENTLY contractors need small compressed-air outfits which will operate one or two rotating type hand drills, riveters or other work, but feel that a large air-compressing outfit would not be warranted. The Rix Compressed Air and Drill Company, 505 Howard Street, San Francisco, Calif., manufactures outfits which are used by state highway departments and contractors to advantage

automatic unloading device and tool equipment.

The engine and compressor are mounted on heavy I-beams or channel iron, as shown in the illustration. The engine is connected to a compressor by a friction clutch, the final drive being through a single gear or a chain of gears, depending on the size of engine and compressor used. By using a clutch, the engine can be started independently of the compressor. The



A CONVENIENT PORTABLE OUTFIT FOR PNEUMATIC TOOL WORK

in furnishing compressed air for road work. The engines for these machines are either 2 or 4 cylinders, according to the power necessary. The 4-cycle heavy-duty motor-truck type is equipped with high-tension magneto and hot tube high-grade carburetor. The compressors are of the standard Gardner-Rix type with light steel, practically indestructible, valves and splash oiling systems. They are complete with

engines are rated at 800 r.p.m., which insures ample power, for they are run at 50 per cent increase of this speed in truck work, and corresponding increase in power. The outfit shown is mounted on wheels for ready transportation and consists of a 6 x 9 Duplex Gardner-Rix compressor, connected to a 40- or 50-horsepower, 4-cylinder, heavy-duty tractor engine, burning low-grade fuel.

Care of the Motor Truck

Loading Accessories Materially Lengthen Life of Truck

PERHAPS the most abused piece of equipment in use to-day is the motor truck. A great deal is expected of it, and it has been fulfilling expectations in a remarkable manner, with little or no attention. Its exceptional performance and efficiency have led many contractors to overestimate the endurance of the motor truck, with the result that such equipment is occasionally in the repair shop, because of thoughtlessness and abuse.

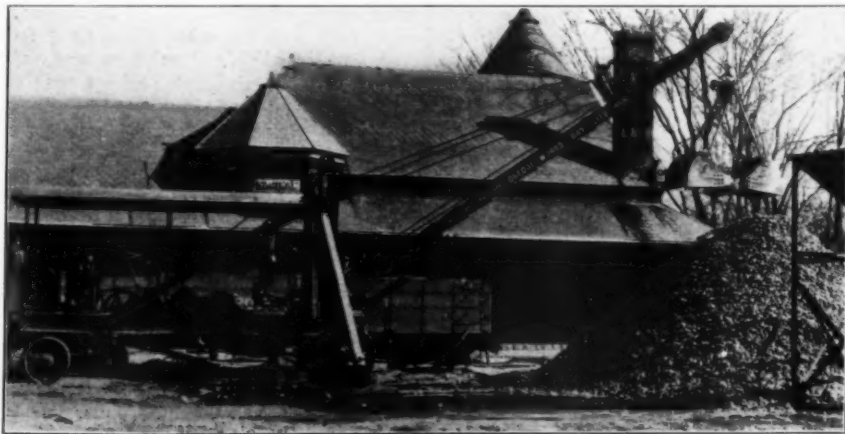
Attention to the proper care of the mechanical units of the motor truck is, of course, of primary importance, yet it is well to give an occasional thought to the treatment and use to which the chassis is subjected. The sudden jolt and shock by dumping a three-quarter-yard clam-shell full of crushed stone into a truck body is a thing that in course of time may result in weakening, if not crystallization, of the springs.

Alex Jeffries, road contractor, operating near Saginaw, Mich., in addition to using up-to-date loading machinery in place of hand labor, is very considerate of motor trucks. Mr. Jeffries is using a loading hopper manufactured by the Bay City Dredge Works, Bay City, Mich., in conjunction with his Bay City motor crane. This hopper is constructed of steel plates and angles, and has a capacity of 3 cubic yards water

measure. It has a clearance of 12 feet from ground level, permitting a truck to drive alongside to be loaded. Two chutes are provided, independently operated by hand winches. Trucks are filled instantaneously and with the least possible wear and tear. The trucks and drivers are not compelled to lose time waiting for a load.

Mr. Jeffries is using this hopper, which is easily transported, in connection with the motor crane, operating a three-quarter-yard clam-shell bucket. This crane is self-propelling and mounted on tractor wheels. Power is furnished by a 40-horse-power, four-cylinder Twin City gas engine. The machine is being used to unload crushed stone for road work from railroad cars, to build a stock pile and to fill the hopper, all operations being handled from the same location at a very low cost.

The crane is most substantially constructed, using I-beams for the car body. It is equipped with a 30-inch steel boom, with tag lines operating inside the boom channels, out of the way. This tag line may be used to carry current to an electric magnet. A 40-foot boom can be secured for derrick use, or mounted in connection with a shovel type dipper, for excavation work. The operating levers are all conveniently located in the front of the ma-



SMALL POWER CRANE FOR FILLING LOADING BIN FOR MOTOR TRUCKS

chine, giving the operator a clear and unobstructed view of his work at all times. The crane can be mounted on tractor wheels, creeper trucks, or railroad wheels of any gage.

Probably as many contractors have been ruined financially by failure to take care of their equipment, including motor trucks, as have become bankrupt through underbidding, poor estimating and the tyranny of the inspector.



LOADING TRUCKS FROM THE BIN

A Big Job Successfully Completed

The Construction of the Albert Lea Concrete Water-Tower and Reservoir Presented Some Difficult Problems, Which Were Successfully Overcome

By E. R. Tarnoski

McManis & Tarnoski, Contractors & Engineers, St. Paul, Minnesota

THE successful completion of this big job was an undertaking which required considerable time and engineering skill, and it was only after these two essentials had been secured that this concrete water-tower and reservoir were finished. It is situated in the town of Albert Lea, Minn.

At the time of the letting of contract considerable skepticism was evidenced by the town people, as well as by some members of the council, as to the advisability of the construction of a water-tank wherein reinforced concrete was to be used as a medium to impound water under pressure. On account of these doubts the council passed a resolution deciding to postpone the date of the letting for another thirty days, so as to be able in the meantime to gather information from other sources where tanks for water-supply service of this character were in use. It is needless to state here that on the date of the second letting all doubts as to the use of concrete for the construction of the tank were eliminated by the encouraging reports received from these sources.

The pressure tank and reservoir are con-

structed in what may be termed the central part of Albert Lea and within 100 feet of an artificial lake known as Fountain Lake. This enables equal distribution of even pressure all over the city.

The location of the site for the structure is on the side of a hill. This made the excavation rather difficult, as one side of the hole to be excavated would be about 30 feet deep, and the other side only 5 feet. On account of this slope there was some doubt as to the advisability of construction, since it was believed that a slippage towards the lake would occur. However, instructions were given to proceed with the excavation with a view to deciding whether or not piles would be required. After the excavation was completed, a thorough test was made, and it was decided that the soil strata were in such a position that piling would not be required for preventing slipping as well as for soil pressure.

The bottom or foundation of the structure is 100 feet in diameter, with the exception of the central 45 feet, which is 18 inches thick; the remaining portion of the plate being 1 foot thick.

A considerable amount of reinforcing

steel was used for this lower plate. Seven-eighths-inch rods were used in the top and bottom of the plate, running radially as well as circumferentially over the entire area. About 16 tons of steel were used for this footing plate. Before the concrete for the plate was set, dowels were placed on a circle of 30-foot diameter at 8 points, to provide for connection of the columns which were to be used as supports for the pressure tank.

After the foundation plate was finished, it was decided that the tower should proceed in construction first, because of advantages gained for constructing it. Slip forms were used in erecting this structure.

There are curtain walls between the 8 columns, which serve as a shelter for valves and other instruments required, as well as for a stairway which is used to reach the balcony floor level below the pressure tank. The tower supports, as well as the curtain walls, were run solid up to a point about 32 feet above the foundation plate. At this point slots were made in the concrete between the columns, so as to receive the roof slab of the reservoir.

These slots were left in the wall to provide for continuous reinforcement for the roof of the reservoir and working floor, which were constructed at this point. From this point on, concrete was run, and provision was made at three levels for windows and doors. In all, there are twenty-three windows and one door used in the structure.

At a level of 110 feet above the foundation plate a balcony floor was constructed. Four feet above this floor a curtain wall between the columns was left open so as to provide a balustrade around the balcony floor, and from this point on, the opening was made in the form of an arch up to the bottom of the pressure tank floor. This

point is about 120 feet above the foundation plate and forms the bottom of the pressure tank, and the roof of the pressure tank is 150 feet above the foundation level.

The pressure tank is 30 feet high and 30 feet inside diameter, and it is covered with a reinforced roof. Battlements are placed above the roof level to relieve the monotony of the structure and thus improve the appearance.

The reservoir below is 100 feet in diameter, and the outside walls are 30 feet high. There is a roof over this part of the structure, which rests on the wall of the tower and the outside walls of the reservoir, and between these two points there are a series of eight columns, which in turn are connected with heavy concrete beams. There are also battlements above the roof level of the reservoir.

The capacity of the pressure tank is 125,000 gallons, the floor is 24 inches thick, and the walls are 9 inches thick. The columns that support the pressure tank are 15 by 36 inches, and the curtain walls are 6 inches thick. The roof of the pressure tank is 7 inches thick.

The capacity of the reservoir is one and one-half million gallons, and the outside walls are 12 inches thick and the roof 8 inches thick. The concrete used for the reservoir and the reservoir plate as well as the pressure tank is in a proportion of 1:2:3. The concrete for the remaining portion of the structure has a proportion of 1:2:4. There were about 114 tons of reinforcing steel used in this reservoir and tank, and about 2,500 barrels of Atlas Portland Cement.

J. H. A. Brahtz of St. Paul, Minn., was the consulting engineer and designer of this tank and reservoir.

ACKNOWLEDGMENT:—Courtesy of Contractor's Atlas.

Making Haste Slowly

In announcing the second cut of the year in steel prices the steel companies are apparently but feeling their way. The first cut of 10 per cent, made in April, had little if any effect in construction. Will the present cut of approximately 10 per cent have any great effect on the present situation? We doubt it.

A spectacular reduction in prices of steel products might do something to get the public started, for other material manufacturers would be inclined to follow suit, and nation-wide notice of the event would possibly stir the public to action. If prices were actually to drop to rock bottom and, if necessary, below, temporarily, construction this year might have a chance, while the law of supply and demand would ultimately equalize prices so that no material manufacturer would unduly suffer.

A process of stepping down, however, may prove safest for the steel companies and in the long run will be helpful; but not much solace can be gathered for the present season from action of this kind. The steel manufacturers are conservative business men rather than strategists. Perhaps they prefer to make haste slowly.—A. G. C. Bulletin.

Coördination of Machinery in Road Construction

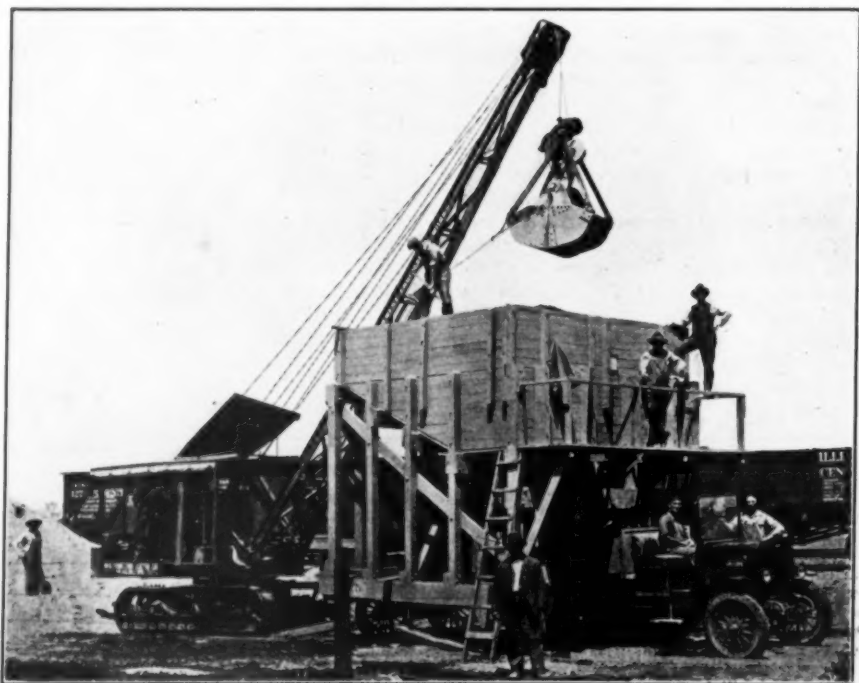
Careful Selection and Operation of Road Machinery on Dodge County, Wis., Job Shows Contractor's Insight

THIS story of the relation between the materials on hand and the successful rapid construction of a highway project, is centered about the work of the Wisconsin Construction Company, of Milwaukee, on the Horicon-Beaver Dam Road, on Route 118, in Dodge County, Wisconsin.

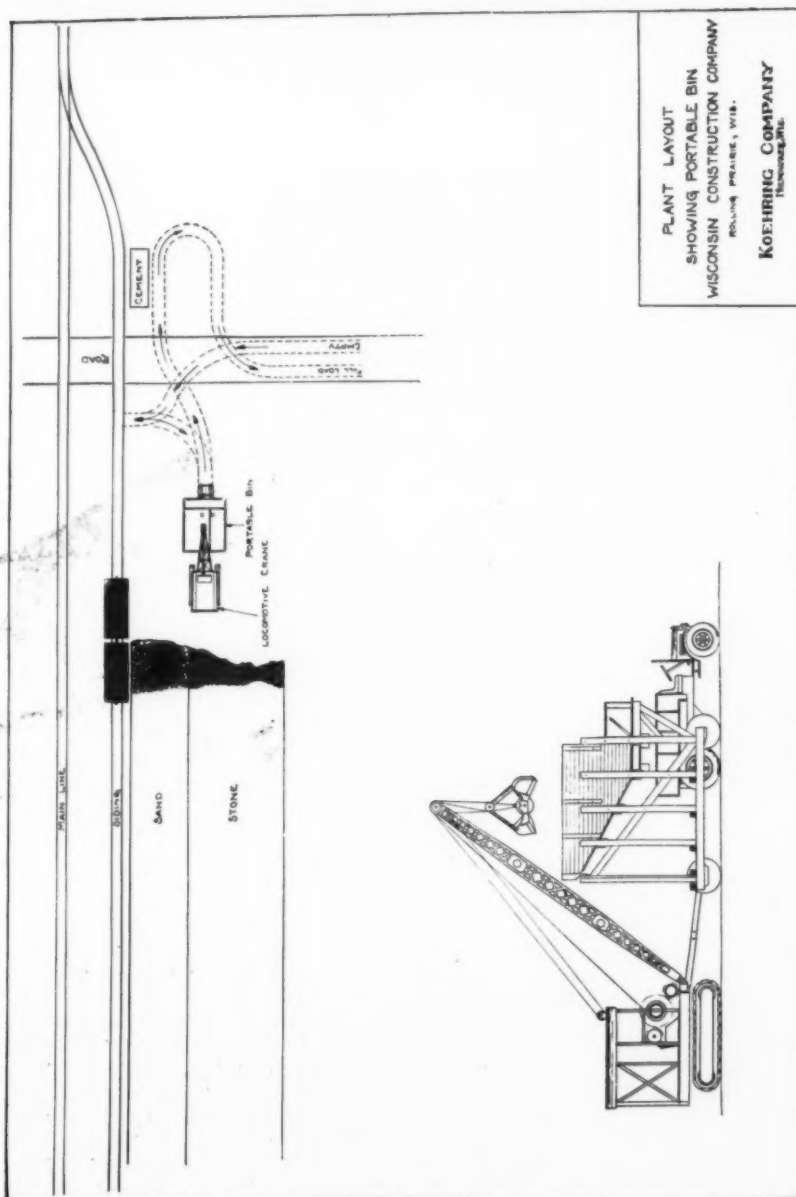
Nearly two months before the mixer was on the job the locomotive crane was unloading all the sand and stone that could be obtained. Ten or twelve cars per day were placed in storage, until, when the mixer was ready to start, 10,000 yards of materials were on hand, or sufficient to complete nearly four miles of 18-foot roadway. At Rolling Prairie, the shipping point, the contractor found a passing-track about 1,000

feet long. The use of this he obtained for handling his aggregate cars.

The crane, which has a 40-foot boom, unloaded the sand into a pile approximately 20 feet wide at the base. The stone was unloaded in a parallel pile approximately 50 feet wide at the base. In laying out the plant it was planned to store more than one-half as much sand per foot of pile as of stone, the reason being that the crane must move longitudinally and must at all times be back of the stone pile. In case an insufficient amount of sand is delivered, the excess allows leeway before the stone pile is in the way of the crane. In case stone is not delivered and sand is delivered, the crane can operate from the sand pile with



A NORTHWEST ENGINEERING WORKS TRACTION TYPE CRANE LOADING AGGREGATE INTO A STORAGE BIN, FROM WHICH THE NASH TRUCKS HAUL IT TO THE MIXER.



LAYOUT OF THE WISCONSIN CONSTRUCTION COMPANY'S PLANT ON THE HORICON-BEAVER DAM ROAD, DODGE COUNTY, WIS.

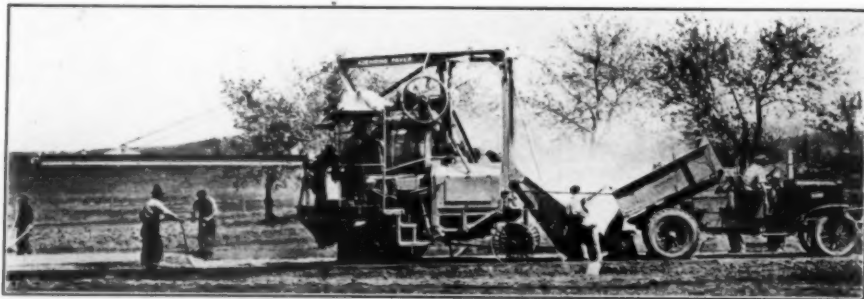
ease, handling the sand directly from cars to bin, and stone from the storage pile to the bin.

To make this operation complete, a portable bin was necessary. The bin is approximately 14 feet square and 18 feet high, made of white oak throughout. It is mounted on road wheels, 40 inches in diameter and with a 12-foot base. Attached by the rigid 10-foot pole to the crane mounted on multi-planes, it moves forward as the crane moves, thus making unnecessary the peaking of the boom at any time. The bin is supported at three points—the two rear wheels and the fifth wheel of the front axle. In this way strains due to uneven bearing are reduced to a minimum. Forty yards of aggregate, fifteen yards of sand, and twenty-five yards of stone are carried at all times in the bin. Two measuring hoppers are mounted below the bin floor, so designed that they can be adjusted to fit any proportion. Levers con-

into the boom bucket. This bucket is of the spreading type; in other words, the door opens crosswise instead of longitudinally. It consists of a single leaf, hinged at the back of the bucket, which is released by the operator from his platform. The concrete is spread in an even layer as the bucket is drawn back. In case it is desired to push the concrete into a corner of the form, this can readily be done by reversing the motion of the bucket.

The organization of the crew is as follows:

- 1 crane operator
- 10 cleaning up cars and assisting around plant
- 7 handling cement at cars and warehouse
- 1 bin operator
- 1 loading foreman
- 11 trucks with drivers
- 2 dumping trucks
- 1 mixer operator
- 6 finishers



LOADING THE SKIP OF THE PAVER DIRECT FROM THE MOTOR TRUCK

trolled from the platform operate the upper and lower cut-off gates.

The two compartment trucks back under the bin, receive $27\frac{1}{2}$ cubic feet of aggregate in each compartment, and drive to the cement shed, where they are loaded with $2\frac{1}{2}$ barrels of cement, the bags being emptied directly on top of the aggregate. The truck hauls the material to the site of the work. Here it turns and backs into the skip of the 21E Kochring paver, discharges the load and moves forward about 2 feet. The skip is then raised, the material charged into the drum of the mixer, the skip lowered, and the truck again backs into the skip, discharges the second batch and leaves for another load.

When mixed, the concrete is discharged

- 2 form setters
- 4 extra men sprinkling and covering pavement
- 7 or 8 men on grade ahead of mixer

The finishing is done by hand by the use of a strike-off board followed by the roller and belt.

The day following the placing of the concrete it is protected by covering with earth. The success of this operation is shown by the fact that the first mile of highway was built, even with an average round-trip haul of between 7 and 8 miles, in 9 working days. This does not mean 9 calendar days, for because of rainy weather it was possible to work only 9 days out of 20. This quantity was placed with a green crew and green truck drivers.

Sheets or Rolls?

Some Cost Data on the Use of Rolls, Upon Which to Base an Opinion

By G. E. Land

WHILE wire mesh has become recognized as the most economical type of reinforcement for concrete roads, there is still a great difference of opinion as to whether rolls or sheets are the most economical to handle and place.

Much has been said and written on the subject, but, for the most part, the opinions and conten-



MANUFACTURING



UNLOADING

This section of road, known as route No. 133, Upper Darby and Haverford Townships, is 12,077 feet (2.28 miles) long, reinforced cement concrete type, 6-, 8-, 6-inch section, 18 feet wide, and carried 57 pounds of metal to 100 square feet. Specifications require that the main members of the fabric reinforcement be placed transversely with the road to within 2 inches

tions are based on theory rather than upon actual practice. For engineers and contractors seriously interested in the facts, we give in this article the cost data for fabric reinforcement in rolls taken from the records of Vincenzo Di Francesco, of Llanerch, Pa., who is building the first section of road to be let under the 1921 Specification of the State of Pennsylvania.



HAULING



STORING

of the side forms; that the sheets be lapped 4 inches, and placed in the slap 2 inches below the crown.

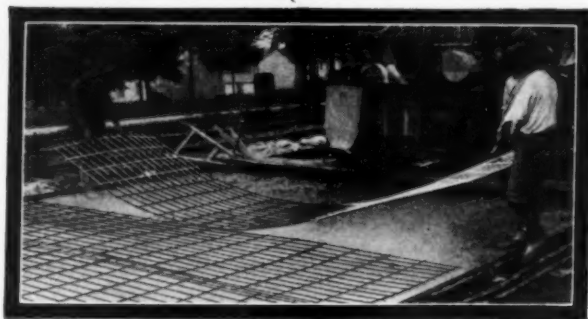
National road fabric (style 1257 manufactured by National Steel Fabric Company of Pittsburgh, Pa.), weighing about 57.6 pounds per 100 square feet, was used. Each roll contains 125 feet of fabric 58 inches wide and weighs 360 pounds, containing approximately 8,420 square yards to the car-load of 130 rolls.

Unloading a car-load of fabric, loading onto trucks, hauling $1\frac{1}{2}$ miles, is accomplished in a single day. With two laborers, each at 35 cents per hour, and a truck and driver at \$30 per day; the total cost is \$37, making the cost of handling and hauling \$.0044 per square yard.

Straightening, measuring, cutting and placing alongside the road takes from 15 to 18 minutes per roll. Taking 54 man-minutes as the average, the time required for these operations in connection with a car-load of fabric is 7,020 minutes, or 117 hours. With

labor at 35 cents per hour, this total cost would be \$40.95 or \$.0049 per square yard.

Placing the fabric in the concrete takes one man about $\frac{1}{2}$ -day; making an arbitrary charge of \$2.50 for this work ($\frac{1}{2}$ the daily wage of a \$5.00 a day man), and based on the average number of feet of road laid per day, namely 358 feet, brings the cost of this operation



PLACING

to \$.0036 per square yard.

The total cost of these three figures (\$.0044, \$.0049 and \$.0036) is \$.0129, or about $1\frac{1}{4}$ cents per square yard.

We might justly eliminate the cost added for placing the fabric in the concrete, as the same number of men will be needed behind the mixer whether the fabric reinforcement is used or not; then the cost would be under \$.01 (1 cent) per square yard.

The contractor's cost for the first week of the work was \$.014 per square yard, which might be attributed to the newness of the work and the lack of familiarity with the cycle of operations.

Who Makes Concrete Mixers?

Frequently you are confronted with the question of who makes a specific kind of equipment. By consulting the "Where to Purchase" directory beginning on page 3 of the CONTRACTORS' AND ENGINEERS' MONTHLY your query is quickly answered.

HANDY CATALOGS

The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

HELP CONTRACTORS

RUGGED STEAM SHOVELS

Bulletin C-G, which may be secured from the Bucyrus Co., South Milwaukee, Wis., describes Bucyrus steam shovels, the reason for their speed, ruggedness and power, which results in profits to contractors.

ALL TYPES AND SIZES OF ROAD ROLLERS

Catalog A of the Buffalo-Springfield Roller Co., Springfield, O., describes in detail Buffalo-Pitts and Kelly-Springfield rollers, both steam and motor, with or without scarifier attachments.

CONCRETE ROAD REINFORCEMENT

The advantages of National road fabric, which is a welded rigid fabric, shipped in rolls, are described in detail in the latest catalogs and price lists of the National Steel Fabric Co., 909 First National Bank Bldg., Pittsburgh, Pa.

SEWER AND CULVERT PIPE

Full information regarding the cost of sewer and culvert pipe, wall coping, flue linings, building blocks, drain tiles, fire clay, etc., may be secured from the Delaware Clay Products Co., 708 West-inghouse Bldg., Pittsburgh, Pa.

DECORATIVE METAL COLUMNS

The Union Metal Manufacturing Co., Canton, O., has just issued an attractive illustrated catalog describing Union metal columns for porches, pergolas and interiors. This will be of particular interest to building contractors, including those engaged in new construction as well as remodeling.

CONTRACTORS' EQUIPMENT IN HOISTING AND HANDLING MACHINERY

The J. S. Mundy Hoisting Engine Co., 727 Freling-huysen Ave., Newark, N. J., has issued a very complete catalog No. 16, describing its complete line of hoisting and handling machinery and contractors' equipment.

WHEELBARROWS, SCRAPERS AND TRUCKS

Catalog No. 42-14, issued by the Kilbourne & Jacobs Mfg. Co., Columbus, O., contains illustrated data and descriptions of its full line of steel and wood wheelbarrows, concrete carts, drag-scrapers, wheelcrappers, road plows and trucks.

SPECIFICATIONS FOR ROCK ASPHALT ROADS

The Kentucky Rock Asphalt Co., Inc., 711-718 Marion E. Taylor Bldg., Louisville, Ky., will be glad to send copies of its specifications for building roads and streets using rock asphalt as a surfacing material, also specifications for patching brick, cement, concrete, water-bound macadam and bituminous types of roads and streets.

THE VALUE OF LIQUID CHLORINE

The value of liquid chlorine in sterilizing water and sewage is well appreciated. A booklet regarding the use of this sterilizing material may be secured by writing to the Electro Bleaching Gas Co., 18 East 41st., New York City.

METERS FOR ALL LIQUIDS

The National Meter Co., 299 Broadway, New York City, manufacturers meters for oil, gasoline, syrup or any other fluid and will be glad to furnish information and data to anybody having a liquid-measuring problem.

EXCAVATOR CRANES

Bulletin 6X issued by the Excavating Machinery

Div., Pawling & Harnischfeger Co., Milwaukee, Wis., describes the use of P. & H. excavator cranes for making cuts, grading, filling in, shouldering up and handling such materials as sand, gravel and structural pieces, etc.

DEPENDABLE DINKEYS FOR CONTRACTORS

If a contractor is looking for industrial locomotives that are always on the job and dependable throughout, he should write to the H. K. Porter Co., Pittsburgh, Pa., and ask for the latest literature covering Porter Dinkeys.

THE CONSTRUCTION AND REPAIR OF ASPHALT ROADS

The Standard Oil Co. of Indiana, 910 S. Michigan Ave., Chicago, Ill., has issued a booklet, "Stanolind Paving Asphalt," which contains a great deal of information of value to contractors, engineers and officials who are building asphalt pavements of all types.

STEAM SHOVELS

Contractors wishing information regarding a shovel which has a fine record for moving dirt, should write for the latest literature describing the Marion "21" to the Marion Steam Shovel Company, Marion, Ohio.

RUST-RESISTING PROTECTIVE PAINTS

In a small booklet entitled "Solvay Protective Paints," the Smet-Solvay Co., Syracuse, N. Y., gives complete information regarding its full line of rust- and corrosion-resisting paints for iron and steel, together with a list of all possible uses of such paints, listing the paint best suited for that particular material and use.

THE PROPER USE OF CEMENT

This is the title of a small vent-pocket pamphlet issued by the Lehigh Portland Cement Co., Allentown, Pa., which discusses in a practical non-technical manner the aggregates, methods of mixing and placing, and suitable mixers, and contains readily-understandable tables for the contractor.

POWERFUL TRACTORS FOR ROAD WORK

Full information regarding 22-40 and 35-70 Minneapolis tractors, specially built for heavy road work, may be secured from the Minneapolis Threshing Machine Co., Hopkins (West Minneapolis), Minn.

COMPLETE LIST OF USED EQUIPMENT

The Searchlight Section of the Engineering News-Record, 475 Tenth Ave., New York City, contains very valuable weekly lists of used contractors' equipment for sale, rent or exchange covering every section of the country. Write for free copy.

ALL-STEEL CONCRETE MIXERS

Keystone concrete mixers, made either in the power-loader, low-charging or half-bag sizes, and adaptable for all types of concrete work, are described in detail in Bulletin No. 10-CE, which may be secured from the Gray Iron Foundry Co., Reading, Pa.

WOOD STAVE PIPE AND FLUME

The Continental Pipe Mfg. Co., Seattle, Wash., will be glad to send information and data regarding wire-wound wood pipe, continuous-stave wood pipe and continuous-stave wood flume, creosoted or untreated, to contractors and engineers interested in this type of pipe for water distribution.

COMPLETE ROAD BUILDING EQUIPMENT

The Universal Road Machinery Company, Kingston, N. Y., has ready for prompt shipment the complete line of Reliance road building and quarry equipment, which is described in detail in its catalog and price list which may be secured free on request.

WATER-MAIN LEAKS LOCATED

Details of Pitometer surveys for locating underground leaks in water-mains may be secured from the Pitometer Co., 52 Church St., New York City.

TAPPING MACHINES, BRASS GOODS

Full data regarding Mueller water-main tapping machines, as well as literature on all kinds of water-works, gas-works and plumbing brass goods, may be secured from the H. Mueller Mfg. Co., Decatur, Ill.

STREET LIGHTING STANDARDS

Illustrated matter describing King street lighting standards, which are used by a great many cities throughout the country, may be secured from the King Mfg. Co., 53 W. Jackson Blvd., Chicago, Ill.

METAL PAILS FOR CONTRACTORS

All kinds of metal ware, including galvanized cans, pails, rubbish cans, etc., are described in the complete catalog of the Rochester Can Co., 109 Hague St., Rochester, N. Y.

STERILIZING WATER-SUPPLIES

The literature of Wallace & Tiernan Co., Inc., Newark, N. J., gives many striking examples and reasons why municipal and private water-supplies should be sterilized with liquid chlorine regulated by W. & T. controllers.

EXPANSION JOINTS FOR PAVEMENTS

The literature of the Waring-Underwood Co., Fernwood Co., Fernwood, Pa., describes in detail the particular advantages of Ideal expansion joints for brick, concrete, stone and pavements.

USED MACHINERY

Contractors interested in securing locomotive cranes, auto cranes, standard-gauge locomotives, cableway drag-lines, or upright boilers, as well as steam shovels, dump-cars and derricks, which have been used but which are in A-1 shape, should communicate with B. M. Weiss, 1324 Widener Bldg., Philadelphia, Pa.

PAVING AND HEAVY-DUTY CONCRETE MIXERS

The Koehring Co., Milwaukee, Wis., in its catalog C describes in detail its 7-to 28-cubic-foot paving mixers, its 10- to 28-cubic-foot heavy-duty construction mixers, and its 4- to 7-cubic-foot Dandies mixers operated by steam or gasoline.

INDUSTRIAL EQUIPMENT FOR ROAD BUILDING

The new Road Catalog No. 100, issued by Koppel Industrial Car and Equipment Co., Koppel, Pa., contains interesting details regarding the use of Koppel industrial cars, batch boxes and trucks for concrete or macadam road building.

THE SHOVEL FOR THE JOB

Catalog B issued by the Wood Shovel and Tool Co., Piqua, O., contains interesting discussions of different types of shovels, as well as illustrations, data and weights of all types of shovels for contracting work.

A THOROUGH MOTOR TRUCK TEST

The Federal Motor Truck Co., 34 Federal St., Detroit, Mich., has issued an interesting bulletin, "Over the Top with a Federal 5 to 6 Ton," which describes in detail an unusual motor truck test of interest to contractors and others called upon to use heavy trucks.

A LIGHT-WEIGHT POWERFUL HOIST

Contractors interested in securing a compact, light-weight hoisting motor, operated by air, should write to Joseph Sampson, Denver Rock Drill Mfg. Co., Denver, Colo., and ask for a copy of the latest "Wauchoist" booklet, describing Model 250.

A STUDY PUMP FOR CONTRACTORS

The American Well Works, Aurora, Ill., has placed on the market a rugged contractors' pump of large capacity at a moderate price. Full information regarding this pump in capacities from 25 to 1,200 G. P. M. may be secured by writing to the company.

A ¾-YARD REVOLVING STEAM SHOVEL

Bulletin 216-A, issued by the Osgood Co., Marion, O., describes the Osgood 18, a traction ¾-yard revolving steam shovel with clam-shell bucket, crane or drag-line. This bulletin contains many interesting features of particular interest to contractors.

FULL REVOLVING CRANES

Byers full revolving cranes, operated by gasoline, steam or electricity and mounted on crawlers or road wheels or rail trucks with any gauge, are described in the literature of the Byers Machine Company, 490 Sycamore St., Ravenna, Ohio.

INFORMATION ON ELECTRICAL EQUIPMENT

Full information on electrical apparatus of every kind for the generation, control, transmission and application of electrical energy may be secured from the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CONTRACTORS' DERRICKS AND CRANES

The Edward F. Terry Manufacturing Co., Grand Central Terminal, New York City, manufactures a complete line of timber derricks and steel cranes for operation either by steam or electricity or gasoline power, and describes them in a 36-page bulletin.

WALL PLUGS FOR BUILDING CONTRACTORS

Folder 67, issued by the Niagara Metal Stamping Corp., 235 Tenth St., Niagara Falls, N. Y., contains descriptions and quotations on Niagara wall plugs in two sizes.

METERS FOR OIL, GASOLINE OR WATER

The Buffalo Meter Co., 2829 Main St., Buffalo, N. Y., will be glad to send literature regarding its meters for different services to those who specify the type desired.

ELECTRIC CONTROL OF GATE-VALVES

The Dean Control System for the distant electrical control of gate-valves is described in detail in the literature of Payne Dean, Ltd., 103 Park Ave., New York City.

COMPLETE CRUSHED STONE MACHINERY

The latest literature of the Weller Manufacturing Co., Chicago, Ill., describes in detail the company's complete elevating, conveying and power-transmitting machinery for stone crushing plants, sand and gravel washing plants, brick yards, etc.

PORTABLE ELECTRIC DRILLS

Black & Decker Manufacturing Co., Towson Heights, Baltimore, Md., will gladly send to contractors their literature describing the particular features of its portable electric drills which have a pistol grip and trigger switch, making the drill very easy for the operator to control.

JAW CRUSHERS WITH TWO-BLOW STROKES

General catalog No. 21, issued by the Austin-Western Road Machinery Co., Chicago, Ill., contains details regarding the Western Aurora jaw crusher, which eliminates springs or toggle that are liable to drop out in the old-type mixers.

CRANES

A circular describing convertible motor cranes, equipped with dipper, clam-shell, hook or scraper buckets, and mounted on railroad wheels, broad road wheels or crawler trucks, for loading, unloading, excavation or material-handling of all kinds, has been issued by the Bay City Dredge Works, Bay City, Mich.

GASOLINE AND KEROSENE ENGINES

The Novo Engine Company, Lansing, Mich., in its new catalog 921 describes the use of Novo gas, gasoline and kerosene engines for operating air compressor outfits, pumping outfits, hoisting outfits.

WEED KILLING

Full information regarding the advantages of Atlas "A" chemical weed killer for use on paths, gutters and roads, may be secured by writing to Chipman Chemical Engineering Co., Inc., 136 Liberty St., New York City.

CIRCULAR FLAME BURNERS

Circular flame burners for heating asphalt, tar and pitch kettles are described in detail in the literature of the Hauck Manufacturing Co., 132 Tenth St., Brooklyn, N. Y.

HANDBOOK OF STRUCTURAL TIMBERS

The Industrial Lumber Co., Elizabeth, La., has prepared a very interesting handbook of structural timbers for contractors' and engineers' use, which may be secured by addressing the company at the address above.

CHIMNEYS FOR INDUSTRIAL PLANTS

The American Chimney Corp., 147 4th Ave., New York City, has published a very interesting illustrated booklet, "Chimneys for American Industries," describing its method of building radial brick chimneys for industrial plants.

CONTRACTORS', ENGINEERS' AND MANUFACTURERS' NOTES

Hercules Purchases Aetna Explosives

The proposed purchase of the Aetna Explosives Company, Inc., Wilmington, Del., has been consummated. Although it has been practically understood since the close of the war that negotiations were under way between these two well-known manufacturers, it was not until the petition of the Hercules Company for permission to purchase the Aetna Company had been acted on favorably by the Circuit Court of Appeals, sitting as the United States Court for the District of Delaware, that the proposition assumed any definiteness.

By this purchase the Hercules Company will acquire high-explosive and dynamite plants near Birmingham, Ala., Emporium, Pa., Sinnomahoning, Pa., Ishpening, Mich., and Fayetteville, Ill., two black blasting powder plants, one at Goes Station, Ohio, and the other near Birmingham, Ala., a plant for the manufacture of blasting caps and electric blasting caps at Port Ewen, N. Y., and a plant for the manufacture of fulminate of mercury for use in blasting caps, at Prescott, Ontario, Canada.

The Horton Steel Works, Ltd.

The Chicago Bridge and Iron Works, Chicago, Ill., announces that its Canadian subsidiary, the Canadian Chicago Bridge and Iron Company, Ltd., of Bridgeburg, Ontario and Montreal, Quebec, has changed its corporate name to Horton Steel Works, Ltd. This name has been selected in honor of the late Horace E. Horton, who founded the organization in the United States in 1865. The Canadian Organization was first incorporated in 1913, and the plant in Bridgeburg, Ontario, was constructed in that year.

New Officers of Pittsburgh-Des Moines

E. W. Crellin, formerly President of the Pittsburgh-Des Moines Company, Pittsburgh, Pa., has resigned from active duty, and W. H. Jackson has been elected President in his place. The other officers who were elected at the same time are O. E. Guibert and W. W. Hendrix, Vice-Presidents, and George A. Smith, Secretary and Treasurer. Mr. Smith has removed from Des Moines to Pittsburgh, and A. C. Pearsall has been appointed General Manager of the Des Moines branch.

Badger Concrete Builds New Factory

A 27½-acre tract of land at Winthrop Harbor, Ill., has recently been purchased by the Badger Concrete Mixer Company of Milwaukee, Wis., for the erection of a factory to

manufacture Badger concrete mixers and McVicker tie plates for the Railway Safety Tie Company. In connection with the new factory, there is to be a workmen's housing development.

New Seattle Office for Central Foundry

Edgar L. Keithley, son of E. A. Keithley, San Francisco representative of the Central Foundry Company, of New York, has opened an office at 1323 Alaska Building, Seattle, Wash., where he will represent the Central Foundry Company, as an assistant to his father. The territory controlled by Mr. Keithley, Sr., whose headquarters are San Francisco, includes Oregon, Washington, the neighboring states and British Columbia. Keithley, Jr., has been recently with the Seattle Plumbing Supply Company for about five years.

French Representative for American Manufacturers

American manufacturers who wish to secure a French representative to handle their products may get in touch with V. Ripert, 48 Rue Gambetta, Nancy, France, who has agents in various parts of France. Mr. Ripert will be glad to receive useful information regarding machinery of American manufacturers who might wish him to represent them, together with explanatory catalogs giving terms of sale, shipping, packing, etc., and the terms of representation. He gives as references the American Consul at Nancy, France, and the Nancy branch of the Comptoir National d'Escompte.

A Book for Building Contractors

The new Fourth Edition of the Building Estimator's Reference Book, by Frank R. Walker, has just come off the press and is receiving even a greater welcome than the earlier editions. This new book is aimed to increase building contractors' profits by enabling them to prepare better estimates and to reduce the losses by eliminating costly mistakes. It also helps to save time and money when buying material or letting sub-contracts. There are 2,100 pages of estimating and cost data, covering the general subjects of estimating, general conditions and overhead expense, excavating and backfilling, caissons, wood and concrete piles, steel sheet piling, foundations, water- and damp-proofing, cement floor hardeners, floors, walks and pavements, cement block construction, reinforced concrete construction, brick masonry, hollow tile construction, stone work, building data, terra cotta, sand blasting and tuck-pointing, carpentry, finished carpentry and wall-board construction, lathing, etc.

This book, with its 2,100 4½ x 6½-inch pages, is well worth its price of \$10.

Gasoline and Steam Machines in Road Building and General Contracting



A BATES STEEL MULE TRACTOR RUNNING THE WESTERN CRUSHER AND CONVEYOR
OUTFIT OF A ROAD CONTRACTOR



C. H. & E. GASOLINE-DRIVEN BILGE PUMP FOR CONTRACTORS' USE IN UNWATERING
FOUNDATION EXCAVATION AND TRENCHES



A WHITE 5-TON TRUCK OWNED BY C. H. WINANS COMPANY, ELIZABETH, N. J., ON A GRADING JOB, BEING LOADED BY AN ERIE SHOVEL

"In order that overhead expense may be kept within reason and highway costs estimated with profitable accuracy, it is essential that contractors have equipment capable of maintaining a steady flow of materials: first, from unloading point to mixer, and second, from there to the finished road. This is the problem confronting the field force and one which must find solution if road building is to become financially safe."—R. C. Marshall, Jr., General Manager, The A. G. C. of America.



A FEDERAL ROAD TRUCK WITH PNEUMATIC TIRES AND DUAL LEE BODIES FOR DOUBLE BATCHES OF CONCRETE

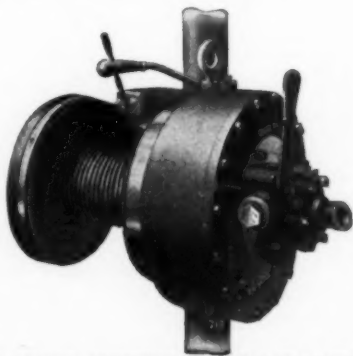
A Small But Powerful Air Hoist

WHILE the Waughoist outwardly resembles a number of other hoists in a general way and is of about the same size and weight as the conventional types of pneumatic hoists now on the market, its manufacturer, the Denver Rock Drill Manufacturing Company, Denver, Colo., claims that it contains many vitally important new features by which it is distinguished from competing machines.

The Waughoist engine is designed as a rotary, first because it is generally recognized as an elemental fact that machines having rotary motion have decided advantages over those of the reciprocating type, and, second, because it was found that such a machine could develop a great deal more power and use less air than the ordinary type. The principal parts of the engine are the motor-housing, the distributor, the cylinder block, the spider, the spider-shaft, and the pistons. The whole engine revolves within the motor housing, an oil- and airtight casting which protects the engine from the atmosphere and also serves as an oil reservoir.

The distributor, through which the air is supplied to the cylinders, is a hardened and ground stationary steel shaft which serves not only as a distributor of power but as a support for the cylinder block as well. Fixed to the spider-shaft is the spider, a drum-shaped casting, which revolves within the motor housing and within which the cylinder block also revolves. Around the inner side of the spider four hardened and ground steel tracks are mounted, on which the piston rollers run. The spider-hub is mounted on a ball-bearing.

The spider-shaft is a carefully heat-treated alloy steel shaft upon which the cable drum revolves. A clutch pinion is mounted on the small end of the spider-shaft so that the cable



A SMALL PNEUMATIC HOIST FOR CONTRACTORS

drum gearing can be disconnected from the engine and the drum permitted to run free when desired.

Within the four cylinders are four heat-treated, precisely ground, drop-forged, alloy-steel pistons, which, as the cylinder block revolves, work in the cylinders and at the same time roll the piston rollers along the track plates on the inner side of the spider, thus practically eliminating the sliding surface friction common to all other types of engines.

The Waughoist develops 5 horse-power at 100 pounds air pressure and lifts 500 to 2,000 pounds vertically at a rate of 68 to 143 feet per minute, depending on the weight of the load. Loads of 500 pounds or less can be handled at pressures as low as 20 pounds. The engine weighs 67 pounds per horse-power and is operated by 1½-inch air hose or a 1¼-inch pipe directly connected.



HANDLING LUMBER IN BUILDING AND GENERAL CONTRACTING

Repairing Modern Pavements

Maintaining Asphalt, Old Granite Block, Brick, Cobble and Rubble Stone Pavements

THE importance of asphalt maintenance manifests itself more and more to city officials as maintenance on the original contract expires. It then becomes the duty of officials to maintain their own streets in the most economical way. The old way of chopping out is expensive, and not satisfactory for several reasons. The new hot material does not weld or vulcanize with the old cold pavement, even though painted with hot liquid asphalt. There being no union between the old and the new material, cracks open up, admitting destructive elements which cause decomposition to set in.

The Lutz method, devised by the Equitable Asphalt Maintenance Company, 1901 Campbell Street, Kansas City, Mo., consists in drawing from a heating chamber a large volume of air, heated to the proper temperature and blowing it with great force upon the asphalt or the bituminous pavement, thereby gently heating and softening the old pavement without flame to the same consistency as the new material. Then with the use of hoe and rake, all disintegrated material, uneven or worn surfaces are removed, and joints cut. While the pavement is still hot, sufficient new material is added to bring it up to the grade and contour of the



AN OLD STONE ROAD BEFORE RESURFACING WITH ASPHALT

street. The temperature of both materials being at the vulcanizing point, and the surface tamped, smoothed and rolled, a perfect weld is produced. Instead of having a patch, the repair becomes a part of the whole.

Nearly all cities have condemned the use of machines which force a flame upon the pavement, because of the destructive effect of the intense heat. Thus the Lutz method becomes the more desirable.

In some of the older cities granite block, brick, cobble and rubble stone pavements were laid before asphalt pavements were known and used extensively. The demand now is for a pavement of easy traction and sanitary and noiseless surface with durability. There are millions of square yards of rough, noisy pavements demanding attention. This is the problem before city officials and contractors to-day.

To remove the old types of pavements to make way for modern asphalt types, has up to the present time necessitated actually taking up granite block or bricks and substituting concrete foundations on which to lay asphalt, which is now considered one of the best modern pavements. There being no market for the disposition of old granite blocks as paving material, this pro-



THE ROAD ABOVE AFTER APPLYING THE NEW ASPHALT SURFACE

cedure is expensive, and thus action is deferred.

Some cities have taken up granite block and brick and laid them down flat, putting binder and asphalt on top, which process has not been completely successful, because the foundation has been destroyed and the binder does not adhere to the smooth surface of the granite, thus allowing the pavement to creep. If a binder is not used, the asphalt sheet is less satisfactory, for there is not enough weight in the asphaltic sheet and it does not adhere to the granite.

By using the Lutz surface heater the present undisturbed condition of the old brick or stone pavement, which forms an excellent

foundation, is maintained. After a thorough cleaning of the pavement, it is gently heated with a continuous blast of heated air through a Lutz surface heater, whereby no flame is permitted to come in contact with the pavement to overheat or burst any part of it. Under the heat the pores of the brick or stone are opened, and while in this heated state it is painted with hot liquid asphalt. After the heat has cooled and the pores have closed, the new asphalt mixture is applied, which makes for perfect adhesion, rendering complete a smooth, noiseless, sanitary street, easy of traction and readily kept clean.

A Big Help to Pueblo

A Full Traction Excavator and Two Steam Shovels Cleaned Up After the Recent Flood

Immediately upon hearing of the disaster at Pueblo, Colo., the Pawling & Harnischfeger Company, Milwaukee, Wis., decided to send one of its full-corduroy traction excavator cranes to assist in the relief work. The excavator was sent in a special car, and with the assistance of the railroad and the Pueblo city officials, no time was lost in transit.

The P. & H. machine was the first one on the job, and later two steam shovels appeared and together with 250 men formed the organization which cleaned up the city. The excavator was equipped with a clam-shell bucket, and the steam shovels with $\frac{3}{4}$ -yard dippers. The material to be removed consisted of mud, wagons, trees, telegraph poles, telegraph wires—or in other words, the most difficult material to handle and load by mechanical means.

The following letter was received by Pawling & Harnischfeger from Pueblo, Colo., ex-

pressing the appreciation of the city for its donation:

CITY OF PUEBLO, COLORADO.

June 22, 1921.

Pawling and Harnischfeger Company,
Milwaukee, Wisconsin,
Gentlemen:

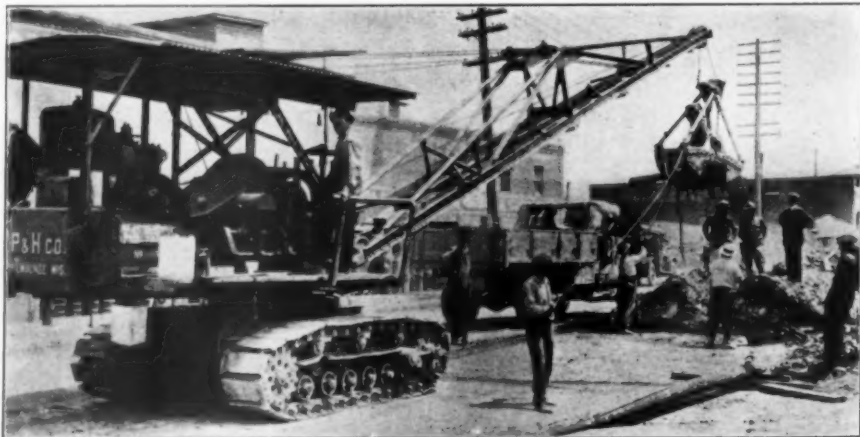
The trench excavating crane so generously donated to our city for use in cleaning up debris, etc., is working on our streets and doing some wonderfully good work. *We estimate this machine is saving us three hundred dollars a day.*

This is by far the most valuable donation made to the city along that line and we appreciate your thoughtful attention to the matter very much indeed.

The confusion into which this disaster has thrown us accounts for our failure to acknowledge your kindness before.

Sincerely yours,
COUNCIL OF PUEBLO.

(Signed) By C. M. Rosz.



CLEANING UP THE DEBRIS AFTER THE PUEBLO, COLO., FLOOD

Metal Lath to Prevent Cracks

Suggestions for Its Use by Building Contractors

THE usual unsightly cracks that are to be found in any of the ordinary plaster partitions, and which add greatly to the fire hazard in a building, can readily be prevented by the judicious use of metal lath.

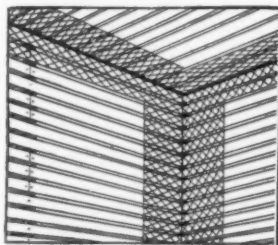
It is not necessary to construct the entire partition with metal lath, although in many cases this may be advisable, but its correct application in the places that are particularly vulnerable to cracks will prove an investment that will be very satisfactory to any builder.

Metal lath acts as a reinforcing for the plaster; affords a base on which the plaster will form perfect and permanent keys; gives a base that cannot swell, work or crack; and lends great strength to the entire wall.

As a matter of general interest this topic is worthy more discussion than can be given here, and anyone wishing more detailed information may get it through any leading manufacturer of this product. It is sufficient to state that there are certain important points in any house where metal lath may be used to protect the plaster from cracks, and yet a very economical cost of construction be obtained. These points are recognized to be as follows:

- On ceilings of prominent rooms
- Lap 6 inches on either side of wall and partition angles and around door bucks
- Back of wainscots and tile mantles
- Across plumbing pipes and heat ducts
- As a base for exterior stucco

Everyone knows how water leaking through a floor will destroy the plaster of the ceiling below. This action is due mainly to the fact that the water soaks into the ordinary lath of the ceiling and causes it to



CEILING AND WALL CORNERS PROTECTED FROM CRACKS BY METAL LATH

This illustrates proper method of bending and applying metal lath

swell, thereby forcing the plaster away from the lath and thus causing more or less damage. For this reason all ceilings that are beneath bathrooms, etc., should be of plaster on metal lath. In this case, if water comes in contact with the ceiling, it readily soaks through without damaging the ceiling, and consequently leaves no mark after drying.

Decoration of any ceiling is rendered unsightly by cracks and by the showing of black outlines of ordinary lath. All architects specify metal lath when they design a ceiling with a special decorative feature. Its universal use in theaters, etc., bears witness to this fact.

Extensive tests made by Professors G. F. Gebhardt and J. C. Peebles at the Armour Institute of Technology, Chicago, prove the value of a corner reinforcement, or cornerite, of metal lath to prevent the corner cracks found at any partition or wall intersection. It has been found that the addition of such a cornerite will protect the corner against any distortion that will not destroy the partition itself. To quote from the report on these tests:

"In thinking of the results of these tests, let us remember that the purpose of metal lath is as a support and reinforcement for the plaster. Many cases will show that where the lath and plaster have been properly applied, a certain amount of rigidity was obtained, but that the deflection and failure of the framework under load had nothing to do with the efficiency of metal lath. It is surprising to note, however, that cracks did not appear in metal lath and plaster walls (properly applied) until after



METAL LATH USED TO PREVENT CRACKS IN BATHROOM WALL

Note use of metal lath around doorway. Metal lath should be used in the same way in kitchens



**NO CORNERITE — CORNER CRACK
DEVELOPED AT DEFLECTION LESS
THAN MAXIMUM ALLOWABLE**

the framework failed, which means that all deflections caused by loads for which the frame was designed will not cause cracks in this type of construction. It is only when overloaded to the point of failure that the cracks will appear."

The results of the tests showed:

1. That metal lath should be applied to the ceilings and carried down 6 inches on all walls and partitions.
2. Metal lath should not be permitted to butt together in the corners, but, to avoid a lap, should be started one stud away, carried to the corner, bent into an angle there and continued along the other wall, the starting point of adjoining sheets alternating from one flanking wall to the other, to break joints.
3. On walls and partitions metal lath should be started at the top and car-



**CRACK DEVELOPED IN CENTER OF
WALL AND STOPPED WHEN IT
REACHED THE CORNER**

ried down, allowing the lower sheets to lap over the upper sheets not less than one-half inch. On the sides the sheets should be lapped not less than one-half inch, and tied once with wire between the supports. When channels are used in connection with metal lath they are usually spaced on 15 $\frac{3}{4}$ -inch centers, and No. 18-gauge black annealed iron tie wire should be used once between supports. No tie wire is necessary when the sheets are lapped $\frac{1}{2}$ inch and nailed or stapled to wood studs spaced on 16-inch centers.



**ORNAMENTAL CEILINGS AND PANELED
WALLS, IN HOUSES LARGE OR SMALL, ARE
PERMANENT IN THEIR BEAUTY WHEN BUILT
ON METAL LATH**

One series tested was of wood lath partitions at an angle of 90° with and without cornerite. The results of this test were interesting because they showed that where metal lath lap was provided in the corner, the crack developed only in the wall proper and in nearly every case was stopped before it reached the corner. It was almost impossible to produce a corner crack. The lap

in the corner had a tendency to minimize wall as well as corner cracks.

Another series of various types of walls showed that where metal lath cornerite was used, cracks in the side walls appeared before the corner cracks. On the other hand (with the single exception of the metal lath walls on which no crack appeared at allowable deflections) the corner crack was the first to appear in the samples in which no cornerite was used.

On a series with the partitions butting on a solid brick wall, it was found that the plaster with the metal lath walls and corners remained uncracked until some time after the allowable deflection was reached. Samples reinforced with cornerite showed no corner crack until the deflection exceeded the allowable maximum.

In every case it was found that the application of a 12-inch strip of metal lath in the corners prevented the formation of corner cracks until the distortion was great enough to destroy the wall itself.

Many cracks have a point of origin behind wainscots, tile mantels, etc. This is due to the extra strain put on the plaster by these items. It is sufficient to use metal lath as a base for the plaster at these points to obtain full protection.

Plumbing pipes and heating ducts cause a local rise of temperature on the plaster adjoining, and will consequently cause some disturbance of the lath. Cold water pipes continually "sweat," and this moisture will soon cause a swelling of wood lath and consequent cracks in the plaster. The easiest solution of this trouble is the use of metal lath over such pipes and ducts.

Any architect or builder who will follow these suggestions will not fail to pro-



A BEAUTIFUL VAULTED CEILING OF PLASTER ON METAL LATH

duce a wall that will retain its perfect condition as long as the house stands. The saving in repairs and necessary frequent decoration will go a long way toward establishing his reputation in the community for work done well.

The Waste in Building

A Portion of a National Assay of Waste

HALF a billion dollars a year in wages is being lost in the building industry through unemployment, it is asserted in a report made public by the Committee on Elimination of Waste in Industry of the American Engineering Council, appointed by Herbert Hoover. Lack of work is declared to be the outstanding fact in this industry, whose critical condition following

the war is attributed primarily to high costs of construction.

Waste, it is said, is causing huge losses in building which, including all trades and common labor incidental to it, ranks second among the industries and contributes to the wealth of the nation more than \$3,000,000,000 yearly.

The chief sources of waste in the building

industry are, according to the report, irregular employment, inefficient management and wasteful labor regulations. Customs or conditions prevailing throughout the industry and poorly designed equipment are given as secondary causes.

The annual economic loss due to accidents is estimated as high as \$120,000,000. Application of safety methods, it is stated, would save to the industry 12,000,000 days a year.

Loss through duplication of estimates and designs, and duplication in bidding, is said to run into the millions. An acute national shortage of housing exists, the committee says, with costs prohibitive to householder and banker. Improvement in production is noted as a result in part of weeding out "war's misfits." Many union rules are condemned as "absolutely wrong." Both employers and employees are blamed for restriction of output.

The committee's investigation covered the entire country, special attention, the report says, being paid to representative cities such as New York, Boston, Philadelphia, Baltimore, Chicago, Cleveland, Atlanta and San Francisco.

Analyzing the causes of building waste, the report says irregular employment is due to seasonal fluctuations, bad weather, strikes and lockouts. Inefficient management is blamed on failure to furnish continuity of employment; failure to plan work in sufficient detail; lack of proper schedules to allow proper coordination of scheduling, purchasing, delivery, with job requirements; lack of standards and adequate cost methods as a means of checking production; high labor turnover; failure to use proper amount or type of equipment; general failure to develop and use a greater amount of mechanical equipment; and waste of material through careless handling and improper plant operations.

Wasteful labor regulations, according to the report, consist of requiring skilled men to do work that could be performed by unskilled, restricting individual incentive through requiring uniform wages, limiting the number of apprentices, excessive reduction of working hours, restricting output by prohibiting the use of labor-saving devices, and jurisdictional regulations.

Additional sources of waste are failure of architects to furnish check plans and speci-

fications, duplication of labor in estimating and often in design, and accidents which are particularly important in the building industry because of the extra-hazardous nature of the work.

An extreme example of labor turnover in Philadelphia is the case of a man who in the course of 5½ years worked for 76 different contractors and was hired 108 times. The report says the enormous turnover causes losses to both employers and men, adding:

"Contractors have given the effect of labor turnover little consideration. In construction work this is particularly hard to determine, especially as the actual percentage of turnover constantly varies as the building progresses and the number of men is increased and then diminished. Men quit because of the type of work they are to perform, risk involved, unfair treatment by foremen, and so on. They are discharged because of lack of work, incompetence, laziness, causing trouble, or because better men are available.

"Allowance of a small margin of profit for both labor and capital during winter months, development of methods of conducting the work in cold weather, arrangement of work to provide indoor operations in cold and stormy weather, organization of a clearing-house for coordination of activities, increasing the usefulness of employment bureaus, and educating the public.

"Contractors must prove to the public that they can carry on operations during the winter period as economically and substantially as during other periods of the year. To do this, contractors, labor, transportation and material men in a locality must all get together and, after joint study of the situation, agree to reduce profits and wages an amount that will offset the increased cost of carrying on work in winter months.

Distribute the Work Throughout the Year

"The education of the public is vital to a sensible distribution of work throughout the year. This applies equally to industrial, public and residential construction and to household repairs and maintenance. Instead of crowding our main construction work into seven or eight months, all that can be deferred from the busy to the more idle season should be so scheduled. Owners making interior repairs or slight additions

should be encouraged to have this work done in the offpeak season. Old buildings to be demolished to make room for new ones should be torn down in cold weather in advance of the new construction instead of waiting, as is often done, until the new building ought to be under way."

The strike is one of the great economic wastes to be found in the building industry, the report declares. "The waste to the men engaged, the contractor and the public is hard to estimate. The major causes of strikes are occasioned by demands for increase in wages, recognition of the union, decrease in working hours, and by jurisdictional disputes.

"Incidental to these causes and often aggravating them are the working conditions, while in almost every case the prime factor is the lack of understanding and failure of the employers and the workers to get together.

"Unions must cooperate to the extent of eliminating the flat rate for all mechanics of a trade, and to the extent of modifying the restriction that forbids mechanics to accept piece work. With definite standards fixed and with the cooperation of both parties fair incentives can be introduced.

"The most encouraging sign in the elimination of the above causes is found in what is known as the 'Philadelphia Plan' put forth by the labor element of that city."

This plan contemplates the organization into a single body through associations, groups or committees, of each employing branch of the building industry in number at least equal to the nineteen represented in the Council of the Associated Building Trades. A heading-up committee, composed of an equal number of representatives from the groups of employer and employed, would constitute the tribunal or council of the building industry in Philadelphia. The plan purposes the establishment of a central bureau through which voluntarily all construction programs in the territory should be cleared, including national, state, municipal and private work.

Use More Mechanical Equipment

General failure of the building industry

as a whole to develop and use a greater amount of mechanical equipment is an established fact, the report says. Greater strides have been made in almost every other industry in the application of mechanical means, it is said. Union objections to labor-saving devices is wrong in principle, it is declared, and will be relegated to the past, like the restriction of output.

"With thorough cooperation of unions with employers and the development of the old guild spirit, which tends to give a man pride in the quantity and quality of his work, there is the possibility of increasing production and, by these means, of maintaining high wages, yet with a resultant lowering of costs," says the report. "Lower labor costs mean more building and more continuous employment for the worker.

"It must be recognized that the unions are by no means alone in their restriction of output. The contractors and builders and supply dealers affect the situation to as great a degree indirectly by maintenance of high prices, collusion in bidding, and unfair practices. Collusion between unions and employers also has sometimes raised prices unduly.

"One of the greatest fundamental causes for low output is the fact that all members of unions in the same trade are paid the same wage. There is no incentive. As a result of records made by the authors on actual construction work, it was found that in the building trades on every job there are usually a few men who do one-third more work than the average man on this same job. These men also do better work. Is it fair to these good men for them to receive the same wage as the others?

"Restriction of apprentices in many cases is extreme and unfair. Overtime and travel rules, also, tend to increase building costs unduly.

"Many unions at the present time have in their by-laws no requirements for restricting output, contrary to good principles. A potent source of labor waste is the jurisdictional practice which distributes certain types of work to different trades, frequently without regard to expense."

Who is the Local Agent for The X Company? If you want to get in touch with a local agent of a well-known manufacturer, consult the Dealers' Directory on page 79.

Making Concrete Blocks for Building Construction

THE increasing use of concrete blocks for building foundations, garages and storage warehouses has brought into the field a large number of contractors who desire to manufacture these blocks for themselves. The Miles Manufacturing Company, Jackson, Mich., one of the well-known makers of cement block machines, has placed on the market the Singer No. 4, a face-down wet-process block machine which has proved successful in actual service for nearly ten years. It is not an experimental machine, but one which will be found in use in almost every portion of the United States.

This machine is adjustable, but consists of very few parts and will make all blocks up to 12 x 20 inches. It is specially built for using a wetter material than is ordinarily used in cement block machines and for this purpose is equipped with verti-



A MILES WET PROCESS CONCRETE BLOCK MACHINE SET FOR A 4 x 24-INCH VENEER STONE

cally-drawn cores, permitting the use of wetter material and making stronger, more dense and moisture-proof blocks. It is of particular advantage to have the machine adjustable, as it enables the contractor to furnish different size blocks for different types of work and to fit particular jobs.

In making the adjustments for different widths of walls, all that is required to make the change is to raise or lower the back plate to the desired point and put in the corresponding end gate. The back plate is bolted to the frame by two bolts on each side, which hold it in place, yet allowing quick adjustment. It is possible with this machine to make bay-window angles, circles, gables and water-table stone, using either a wood or an iron pallet and a very wet concrete.

The blocks are molded face down and the core is inserted horizontally. Then the machine is turned over on its side and the core is drawn vertically. This feature and the sectional feature of the Singer machine make it possible to make a number of half-, third- and quarter-size blocks in combination.



CONCRETE BLOCK MACHINE WITH BACK PLATE AS WELL AS END GATE SWUNG FREE, CORE WITHDRAWN, AND BLOCK READY TO BE REMOVED



Maintaining Park Roads

As a result of careful planning to attain the "City Beautiful," most main arteries of travel from one section of a city to another is through its parks, this produces very heavy traffic.

Quite often, parks containing hundreds of acres had their beginning in just a small plot of ground; additions were made, the management changed frequently, and as a consequence one single park may contain almost every kind of road.

To be able to repair the various roads, a large amount of equipment is required.

The beautiful parkway shown above constructed of

STANOLIND PAVING ASPHALT, "C"

has been in use for over 5 years, and at the present time it is in perfect condition, without one cent having been spent for maintenance.

We believe that no better kind of roadway for parks was ever devised than those of asphalt.

Our booklet "Stanolind Paving Asphalt" containing information regarding this type of road as well as all other asphaltic roads will be mailed free upon request.

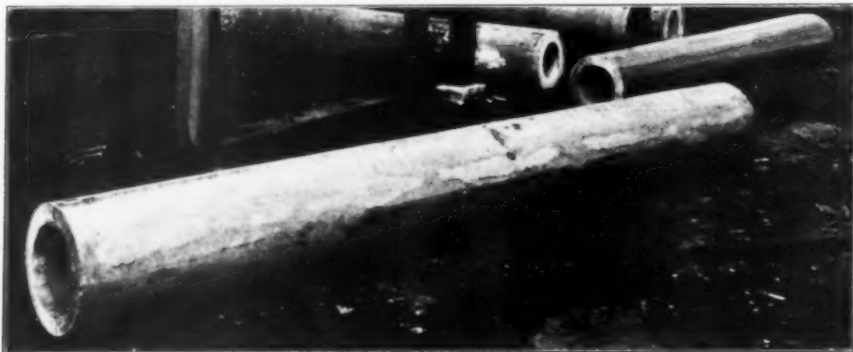
STANDARD OIL COMPANY
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Chicago, Ill.

While some concrete block machine manufacturers claim tremendous outputs for their machines, they make no reference to the conditions which actually govern the output. These include first the number of men employed in the plant, whether the material is mixed by hand or machine, the size of block which it is desired to manufacture, conveniences regarding raw material, water and the distance from curing racks or cars. As a conservative esti-

mate, the average man can make with a Singer machine about 300 blocks measuring $8 \times 8 \times 20$ inches in 8 hours, with two men mixing the concrete by hand. A number of contractors are doing better than this on faced blocks. Where a power mixer and other up-to-date methods are employed, the machine is turning out 400 blocks per day per machine. With a power tamper, the No. 4 machine can turn out 600 blocks per day.



HEAVY-WALLED CONCRETE PRESSURE PIPE

Manufacturing Concrete Pipe in Vacuum

MUCH interest has been displayed in the discovery of the manufacture of concrete products in vacuum, inasmuch as it seems to solve the problem of how to eliminate air and surplus water from concrete, while still plastic, resulting in a very dense and strong product, able to offer great internal resistance to fluids flowing under high pressure. Both 8- and 12-inch Vacucrete pipe is being manufactured by the Vacucrete Company of the Pacific at Oakland, Calif., at present, and has been found tight under hydrostatic pressure of 100 pounds per square inch on the third day after it left the machines, its strength increasing with age.

In the development of Vacucrete pipe, the proper quantity of raw material is introduced into the Vacucrete pipe machine and is either run as a straight concrete pipe or is reinforced with steel. In this way the machine can turn

out a great variety of pipe, suitable for sewers, culverts, irrigation work, and similar less exacting service, up to the high-pressure pipe intended for service as water, gas or oil mains. The diameter and length of the pipe sections are unlimited, so that pipe of small diameter ranging up to 16 feet and longer for sub-aqueous tunnels is possible.

For the manufacture of open tanks for all kinds of service, including pressure tanks for water, air and other fluids, ranging from tanks for home water systems and for air compressor outfits up to tank cars, the Vacucrete process can be used.

Telegraph and telephone poles are also made by this process, as well as piles for foundations, walls, trestles, etc., which are impervious to water and are not readily destroyed by weathering or by the teredo, which has destroyed much wood piling.

Where Was the Highway Contractor?

A bright pupil was required by his teacher to write an essay of 300 words on the new automobile his father had just purchased. After considerable thinking the youngster wrote how his father had bought the machine and a short time later, started away with the

family, going eight miles an hour, and then, unfortunately, got stuck in the mud. The boy concluded his "piece" thus: "I have now used 100 words, and pa spoke the other 200 when we had to walk back through the mud—*Kentucky Association of Highway Contractors.*"

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- 1—Ransome 14-S on wheels with 10 h. p. Novo Engine.
- 1—Ransome 10-S with gasoline engine on wheels.

Several other small mixers, steam and gasoline operated.

Miscellaneous Construction Equipment

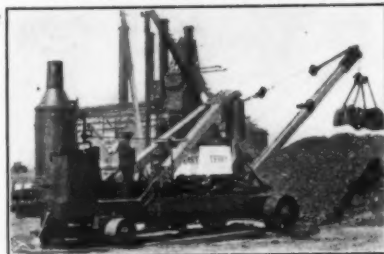
- 2—Byers Auto Cranes on traction wheels steam and electrically operated.
- 1— $\frac{3}{4}$ yd. Bucyrus Steam Shovel on traction wheels.
- 1—No. 3 Keystone Excavator.
- 1—3-ton 24 in. gauge Whitcomb Locomotive.
- 12—24 in. gauge 1 $\frac{1}{2}$ yd. Koppel Dump Cars.
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A Steam Pressure Scarifier

THE accompanying illustration shows a Monarch steam pressure scarifier attached to a Monarch standard steam road roller. This device has recently been brought out by The Good Roads Machinery Company, Kennett Square, Pa., and is manufactured at its Groton, N. Y., plant.

The Monarch steam scarifier consists of a steel bar hinged to the rear end of the roller frame. Attached to the bar are six tool steel picks. The bar is raised and lowered by applying steam pressure to the cylinder piston. The bar, when in lowered or working position, is carried at each end by large wheels that rotate on the ground with the motion of the roller. These wheels are of sufficient diameter so that the teeth enter the ground at any desired depth up to 12 inches. The Monarch operate like other steam scarifiers now on the market, but contains several novel and valuable features, such as an arrangement for folding the teeth, an automatic locking device, and a device for adjusting the slope of the teeth to meet the various kinds and conditions of material to be scarified.

It is claimed that the Monarch scarifier will tear up the hardest material. The teeth can be sharpened when worn. This scarifier is easily and quickly attached to any standard make of steam road roller.



MONARCH ROAD ROLLER WITH STEAM PRESSURE-SCARIFIER ATTACHMENT

Accidents Are Unnecessary

By Walter A. Rogers

Bates and Rogers Const. Co., Chicago.

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The work of the National Safety Council in assisting employers to eliminate accidents tends not only to preserve life, but to increase business efficiency.—*National Safety News.*



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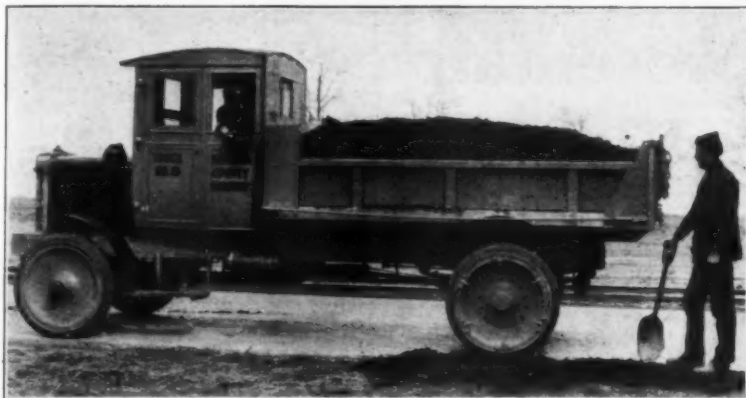
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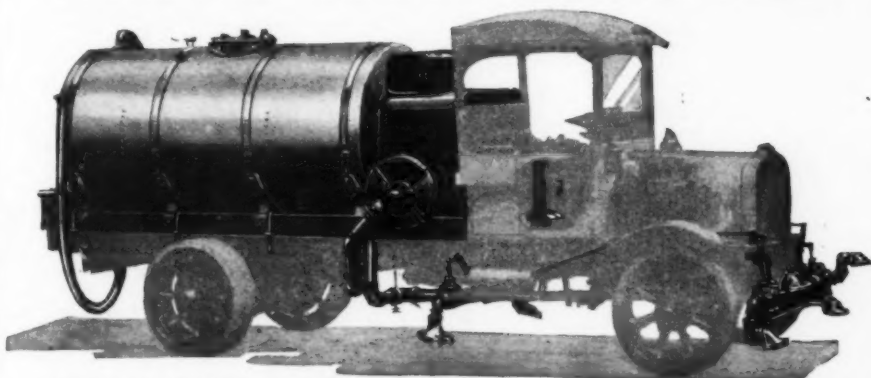
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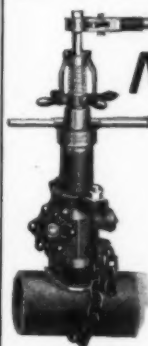
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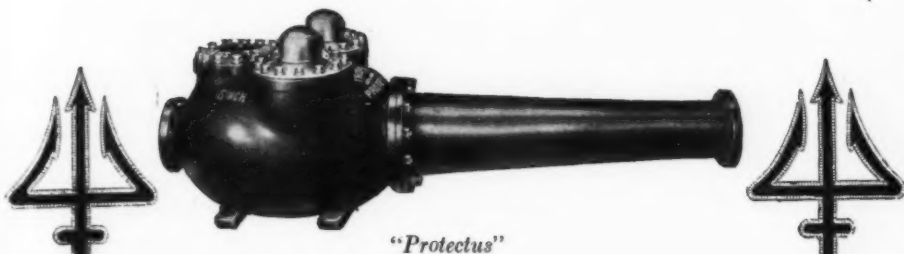
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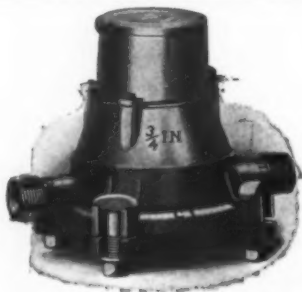
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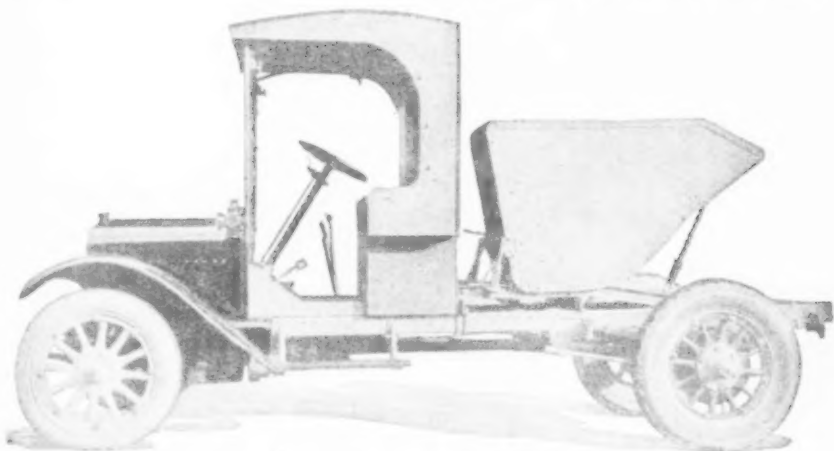
After referring to the "Where to Purchase" Section, on pages 3 to 37, if you will look up the advertisements as per index below, you will be able to secure further data (with illustrations in many cases) on the material or equipment relative to which you are seeking information.

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Manufacturers who advertise in alternate issues may not appear in the above INDEX, but are carried in bold face type in the WHERE TO PURCHASE section at the front of this magazine. Readers wishing catalogs or further information regarding the products of these manufacturers should write to the CATALOG DEPARTMENT, CONTRACTORS' & ENGINEERS' MONTHLY, TRIBUNE BUILDING, NEW YORK CITY.



General Motors Trucks



GMC Road Builder

The GMC Road Builder is a specially equipped motor truck with capacity of one yard of concrete or other material. Body so arranged that load is well balanced on both axles. The special equipment can be removed easily, leaving a regular chassis on which a standard body can be used—making it an all-year utility—This is chassis standardized by U. S. Army and of which thousands were used overseas. Ask any soldier who was in France how they stand the abuse.

*Ask us for special circulars on this Road Builder—
We make trucks in all capacities from $\frac{3}{4}$ to 5-ton.*

GENERAL MOTORS TRUCK CO

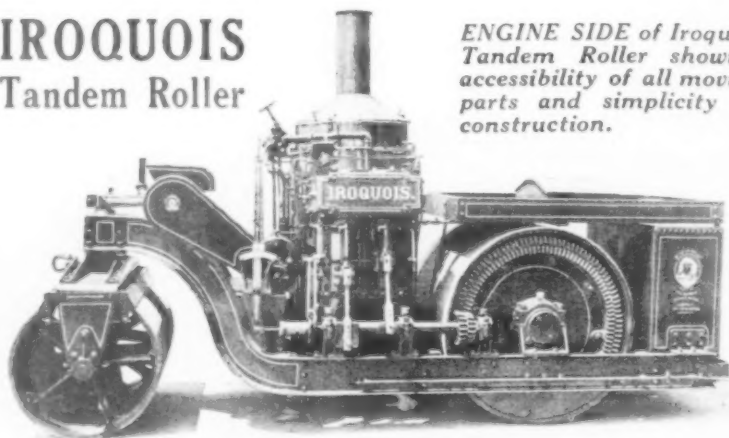
Pontiac, Michigan

Branches and Distributors in principal cities



IROQUOIS Tandem Roller

*ENGINE SIDE of Iroquois
Tandem Roller showing
accessibility of all moving
parts and simplicity of
construction.*



Do you need a roller at once?

A telegram will start an Iroquois Tandem Roller enroute to you the same day. You get the best roller made *in the quickest possible shipping time.* No delay in beginning or completing a contract.

Iroquois Tandem Rollers, like all equipment of the Iroquois Line, are built *specifically* to give long and dependable service at minimum expense. *First cost comes last.*

That is why Iroquois Tandem Rollers are being used by most successful contractors throughout the world—why leading municipalities have adopted them as standard equipment.

Iroquois Tandem Rollers are made in three sizes—2½-ton, 5-ton, and 8-ton—to provide the right type of roller for asphalt, brick, creosote blocks, macadam, grade or golf links.

Why be content with an ordinary roller when you can get an IROQUOIS? Detailed specifications and prices of Iroquois Tandem Rollers and other equipment of the Iroquois Line will be sent on request.



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